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REMOVAL ACTION/FIELD INVESTIGATION
WORK PLAN

JULY 1991

SAAD TROUSDALE DRIVE SITE
NASHVILLE, TENNESSEE

Submitted to:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV

Prepared by

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1.0 INTRODUCTION

This Work Plan was developed to address conditions at the Saad Trousdale Drive Site (the Site) in Nashville, Tennessee in compliance with the Administrative Order by Consent (AOC) dated April 11, 1990. The Site is a one-half parcel of property on which an oil recycling business was operated during the 1970's and early 1980's (Figure 1.1). This Work Plan is a result of recommendations from a preliminary investigation conducted by EMPE at the Site.

On July 3, 1991, the Saad Site Steering Committee submitted a report to Fred Stroud, EPA Region IV On-Scene Coordinator, entitled "The Exploratory Trenching Investigation of the Saad Trousdale Road Site" (EMPE, Inc., 1991). It should be noted that the Site is actually located on Trousdale Drive, not Trousdale Road. The reader should be aware that "Trousdale Road" was the location addressed in the Administrative Order of Consent, but for the purpose of accuracy "Trousdale Drive" will be used in the future when referring to the actual location. The purpose of that report was to summarize the information gathered during the exploratory trenching investigation of the Site conducted on March 25 and 26, 1991. In the report, EMPE recommended further investigation of the nature and extent of contamination resulting from oily residues found during the exploratory trenching activities. Also, recommendations were made concerning other activities necessary to characterize the environmental state of the Site or remove obstacles or impediments to further characterization, e.g. the oil water separator still remaining on-site.

1.1 OBJECTIVES

The primary objective of this Work Plan is to develop/obtain data adequate to evaluate potential remedial alternatives and to establish appropriate response levels. In addition, this Work Plan is intended to provide the flexibility and latitude to allow the EPA On-Scene Coordinator and the Saad Site Project Coordinator to modify the approach to site characterization in the field if unforeseen circumstances arise.

1.2 ORGANIZATION OF WORK PLAN

This Work Plan is submitted in accordance with the aforementioned objectives and recommendations and contains the following sections:

- * General Field Operations
- * Oil Water Separator Removal Plan
- * Drum Characterization Plan
- * Soil Sampling Investigation Plan
- * Storm Water Redirection Evaluation
- * Remedial Alternatives Evaluation
- * Schedule of Activities
- * Health and Safety Plan
- * Quality Assurance Project Plan

1.3 PROJECT TEAM

The Project Team for the Saad Site removal action/field investigation is depicted in Figure 1.2. The Project Coordinator for all work will be de maximis, inc. de maximis will be the primary contact between the Saad Site Steering Committee, EPA, and the Contractor. The EPA on-scene coordinator for the Saad Site is Fred Stroud.

The Contractor's Project Manager will be responsible for the following tasks: overall project management, scheduling, budgeting, contract management, and field operations oversight.

The Site Manager will report directly to the Project Manager. The responsibilities of the Site Manager include health and safety program oversight, Work Plan implementation, and the direction of field operations. The Site Manager will be responsible for the direction of all field activities performed on the Site.

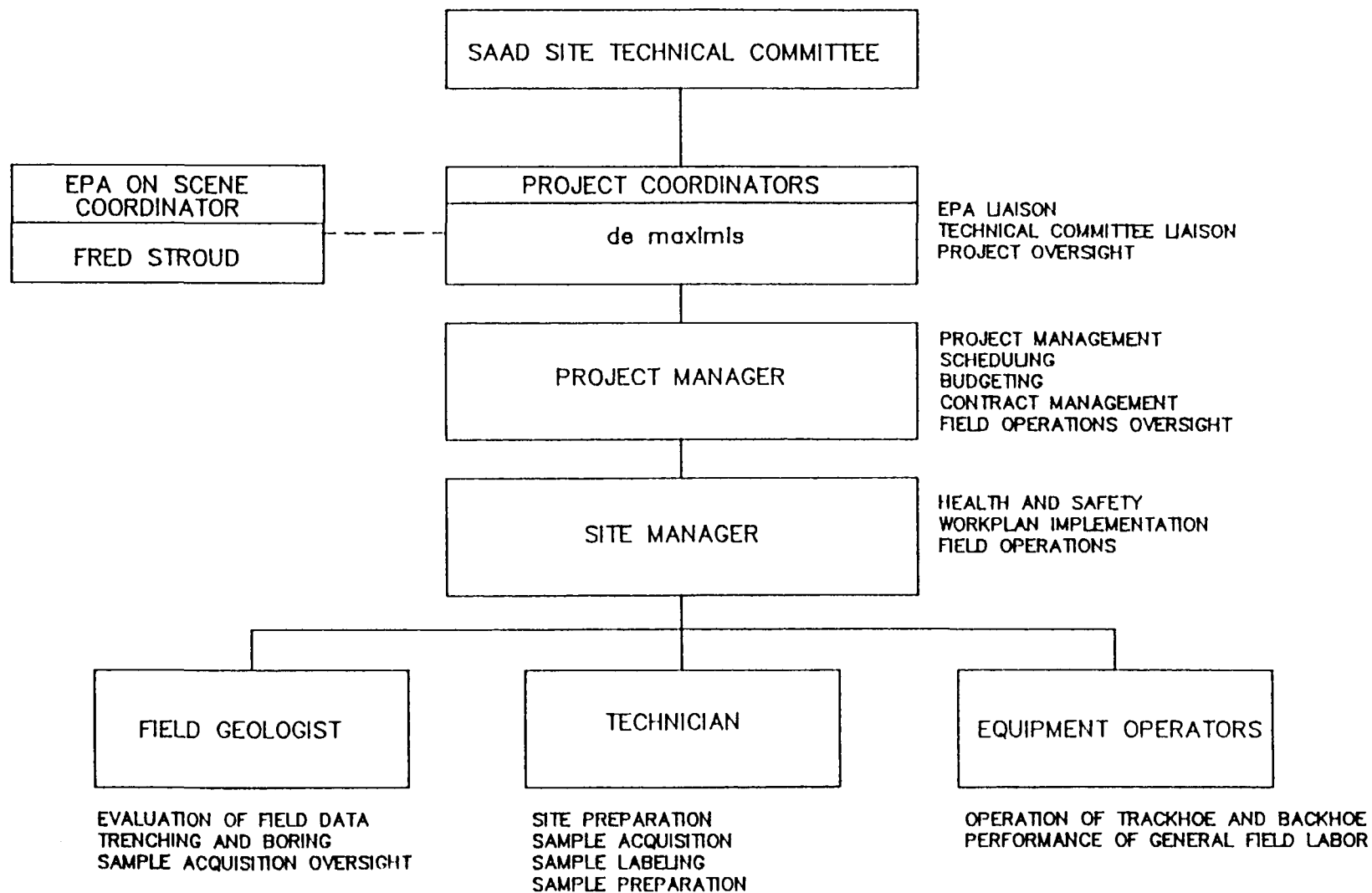


FIGURE 1.2
PROJECT TEAM FOR THE REMOVAL ACTION/FIELD INVESTIGATION
SAAD SITE

Reporting to the Site Manager will be the Field Geologist, the Technician, and the Equipment Operators. The Field Geologist will be responsible for evaluation of all field data, trenching and boring activities, and sample acquisition oversight.

The Technician will be responsible for the mobilization and Site preparation, sample acquisition, sample labeling and sample preparation and storage.

Two equipment operators will be required for this project. The equipment operators will also be responsible for performance of general field labor.

1.4 SEQUENCE OF ACTIVITIES

Initiation of field activities will occur within one week of USEPA written approval of this Work Plan and upon obtaining appropriate access agreements as required under the AOC. The initial activities will include the removal of trash and debris from the Site as discussed in Section 2.1 and shown on the schedule of activities, Section 8.0. The necessary property owners have been contacted and provided access agreements associated with the planned scope of work. Negotiations are on-going and USEPA will be kept apprised of the status of negotiations in the event that assistance in obtaining access should be required as detailed in the AOC.

A detailed schedule of the activities for the Work Plan is provided in Section 8.

1.5 SPECIFIC HEALTH AND SAFETY ISSUES

A Site Safety Plan for the activities described in this Work Plan is included in Appendix I. Specific health and safety issues related only to a particular section of the Work Plan will be addressed in that section.

2.0 GENERAL FIELD OPERATIONS

2.1 SEQUENCE OF ACTIVITIES

Prior to the initiation of the investigation activities described in this Work Plan, the following tasks will be completed:

1. Obtain signed access agreements from Ellis and Kathy Saad, the owners of the Franklin Brick Company, CSX, and the owners of the Klein Coach Company.
2. Receive written approval of this Work Plan from EPA.
3. Remove all scrap metal, trash, and other non-hazardous debris from the Site.
4. Close or relocate the auto body shop operation.

Contractor personnel must have unhindered access to the Site in order to accomplish the tasks set forth in the Work Plan. In order to accomplish this, the scrap metal, trash and non-hazardous debris must be removed from the Site. Contractor personnel will sort, segregate, stage, and prepare for transport and off-site disposal of all non-hazardous materials prior to beginning any of the other tasks in the Work Plan. Examples of the materials targeted for removal are the following: tires, wooden timbers, automobile parts, sheet metal, and empty containers.

After the Site has been cleared of all non-hazardous extraneous materials, the oil/water separator system will be removed. The Oil/Water Separator Removal Plan is detailed in Section 3.

Several of the tasks outlined in this Work Plan will be performed concurrently. Included in this group are the trenching investigation, soil borings, sample collection, and drum characterization. Removal and investigatory activities are scheduled for a period of 150 days. After the analytical results have been received and evaluated, the Contractor will begin to evaluate remedial alternatives for the Site. Storm water runoff and drainage

redirection will be considered as part of the remedial alternatives evaluation process. A report of activities will be submitted to EPA in accordance with the schedule provided in Section 8.0.

2.2 SITE MOBILIZATION

Site mobilization to initiate the primary Work Plan tasks will include the following sequential steps:

1. A site reconnaissance will be conducted to ensure that the auto body shop operation has been moved off the Site, that all extraneous non-hazardous debris has been removed, and that the Site is generally ready for arrival of the Project Team and equipment.
2. Designated members of the Project Team will arrive and delineate the boundaries of the security areas including the contaminated work zone (Exclusion Zone), the transition zone (Contaminant Reduction Zone), and the Clean Zone. Although the entire perimeter of the Site is not fenced, there is limited access created by the fence in the front, railroad berm at the rear and the building walls bordering both sides of the property.
3. The interior of the present LTD Body Shop building on site will be used as headquarters for operations and for storage of equipment and materials. The parking lot across the street from Trousdale Drive will be used for parking with the consent of the owner of the property, Klein Custom Coach. Parking will be negotiated as a part of the access agreements.
4. A decontamination pad will be constructed near the entrance to the rear of the property as detailed in Section 2.3. Water and electricity will be obtained from the existing utilities at the LTD Body Shop.

2.3 DECONTAMINATION PROCEDURES

Cleaning and decontamination of all equipment shall occur at the designated decontamination pad which is located at the entrance to the Saad Site as shown in Figure 5.1. The decontamination pad will contain a shallow pit excavated with the backhoe. The pit and surrounding area will be lined with heavy duty plastic sheeting designed to promote runoff of the rinse water into the pit. The waste waters will be pumped into 55-gallon drums for characterization and disposal. All cleaning of equipment will be conducted above the plastic sheeting. Upon completion of the sampling investigation activities, the pit will be backfilled with the same soils removed to construct the decontamination pad.

2.3.1 Introduction

An area near the on-site building will be designated for use in decontamination operations. This area will be used for equipment decontamination as well as for personnel entering and leaving the Site.

All equipment and sampling devices which come in contact with potentially contaminated materials, soil or water, at the Site will be decontaminated as necessary prior to each use. At a minimum, these decontamination procedures shall consist of washing with detergent and rinsing with tap water. More stringent decontamination procedures will be required for sampling or specialized field equipment.

2.3.2 Safety Procedures To Be Utilized During Decontamination

At a minimum, the following precautions will be taken in the field during decontamination operations:

1. Safety glasses or goggles, gloves, and a Tyvek suit or laboratory apron will be worn during all cleaning operations. When cleaning heavy equipment or drill rigs, steel-toe safety boots will be worn.
2. No eating, smoking, drinking, or any hand-to-mouth contact will be permitted during decontamination operations.

2.3.3 Heavy Equipment Decontamination

All drilling rigs, drilling and sampling equipment, backhoes, and other similar equipment involved in the sampling activities shall be cleaned and decontaminated before entering the Site. All equipment will be inspected before entering the Site to ensure there are no fluids leaking and that all gaskets and seals are intact. All drilling and related equipment entering the Site will be cleaned of any contaminants that may have been transported from another sight thereby minimizing the potential for cross-contamination. Before Site drilling or excavation activities are initiated, all equipment will be thoroughly cleaned and decontaminated at the designated cleaning/decontamination area.

Any portion of the drill rig, backhoe, etc. that will be over a borehole or excavation trench will be steam cleaned and wire brushed before being brought onto the Site in order to remove all rust, soil, and other material which may have come from another site. No oils or grease shall be used to lubricate drill stem threads or any other drilling equipment being used over a borehole or trench. All drilling, trenching and associated equipment that will come into contact with the boreholes or excavation trenches will be cleaned and decontaminated following these procedures:

1. Clean with tap water and phosphate free detergent using a brush, if necessary, to remove particulate matter and surface films. Steam cleaning will be used to remove matter that is difficult to remove with the brush. Drill stems, augers or other equipment which have holes that transmit water or drilling fluids shall be cleaned on the inside and outside.
2. After Step 1, the equipment will be thoroughly rinsed with tap water which may be applied with a pump sprayer or hose from a potable water tap.
3. Rinse thoroughly with distilled water.
4. Any equipment which is to be stored on-site will be wrapped with

aluminum foil if there is potential of contamination of other operations. Plastic wrap will be used to wrap augers, drill stems, etc. after they have been air dried.

2.3.4 Sampling Equipment Decontamination

All hand augers, trowels or other equipment that will be used to collect sample media will be cleaned and decontaminated following these procedures:

1. Clean with tap water and phosphate free detergent using a brush, if necessary, to remove particulate matter and surface films. Steam cleaning may be used to remove matter that is difficult to remove with the brush.
2. After Step 1, the equipment will be thoroughly rinsed with tap water from a potable water tap.
3. Rinse thoroughly with distilled water.
4. Allow to air dry.
5. Any sampling equipment which is to be stored on-site will be wrapped in aluminum foil if there is potential for contamination.

2.3.5 Proper Disposal of Decontamination Liquids

All liquids generated during the decontamination of equipment will be collected, characterized, and disposed appropriately. It is anticipated that the non-hazardous waste waters produced during the field activities may be disposed in the sanitary sewer upon approval from the local publicly owned treatment works (POTW).

2.3.6 Proper Disposal Of Investigation-derived Waste

All personal protective clothing and other investigation derived waste will be drummed and characterized for eventual landfill disposal.

2.4 DRILLING/TRENCHING EQUIPMENT AND PROCEDURES

Drilling and trenching activities performed on the Site will require the use of three major pieces of equipment:

1. Hollow stem auger rig with split spoon sampler
2. Trackhoe (40,000 lbs)
3. Rubber-tired backhoe with front end loader

Immediately after the removal of the oil water separator system (OWS), the trackhoe will be used to obtain samples at the base of the OWS pit. After the pit samples have been obtained, the trackhoe will be decontaminated and then moved to the area at the rear of the Franklin Brick Building to begin exploratory trenching between the railroad berm and the rear of the building as shown in Figure 5.1, Sampling Locations. The purpose of this exploration is to further characterize the settling basin area. Concurrently with the exploratory trenching, soil borings will be performed at approximately 7 locations on site. The boring locations are also shown in Figure 5.1. The rubber-tired backhoe will be used as a general utility vehicle, and for grading and backfilling operations.

2.5 SAMPLING PROCEDURES

2.5.1 Introduction

This section discusses the standard practices and procedures utilized during field operations to ensure the collection of representative samples. The collection of representative samples depends upon:

- * ensuring that the sample taken is representative of the material or medium being sampled;
- * using proper sampling, sample handling, preservation, and quality control techniques;
- * properly identifying the collected samples and documenting their collection in permanent field records (field log books, Chain-Of-Custody Records); and
- * maintaining sample chain-of-custody.

The objectives of this section are to present:

- * general considerations that must be incorporated in all sampling operations;
- * sampling site selection and collection procedures for an individual medium;
and
- * sampling quality assurance procedures.

All proposed sampling locations and rationale for each are included in Table 2.5.0.

2.5.2 Definitions

Grab Sample

An individual sample collected from a single location at a specific time or period of time generally not exceeding 15 minutes. Grab samples are associated with surface water, groundwater, wastewater, waste, contaminated surfaces, soil, and sediment sampling. Grab samples are typically used to characterize the media at a particular instant in time.

Composite Samples

A sample collected over time that typically consists of a series of discrete samples which are combined or "composited". Two types of composite samples are listed below:

- * Areal Composite: A sample collected from individual grab samples collected on an areal or cross-sectional basis. Areal composites shall be made up of equal volumes of grab samples. Each grab sample shall be collected in an identical manner.
- * Vertical Composite: A sample collected from individual grab samples collected from a vertical cross section. Vertical composites shall be made up of equal volumes grab samples. Each grab sample shall be collected in an identical manner.

Miscellaneous sampling definitions are listed below:

- * Sample Aliquot: A portion of a sample that is representative of the entire sample.

TABLE 2.5.0
SAMPLING LOCATION/RATIONALE

Sample Location	Matrix	Rationale
BS-1	Soil	Confirm Southern extent of basin and establish lithology outside basin area.
BS-2	Soil	Establish vertical characteristics of any contamination and lithology within the basin area.
BS-3	Soil	Establish any contamination characteristics between the former tank area and basin.
BS-4	Soil	General vicinity of reported Saad waste oil unloading operations.
BS-5	Soil	Evaluation soil characteristics at SE boundary of the site operations.
BS-6	Soil	Evaluate soil characteristics at NE boundary of site
BS-7	Soil	Evaluate soil characteristics at NW boundary of site
TS-1	Soil	Samples in trench to characterize nature within basin area
TS-2	Soil	Samples in trench to characterize nature within basin area
TS-3	Soil	Samples in trench to characterize nature within basin area
TS-4	Soil	Samples in trench to characterize nature within basin area
SS-1	Soil	Characterization of materials below OWS
SS-2	Soil	Characterization of soils below OWS
D-1	Drum Contents	Drum Characterization
WW-1	Waste Waters	Wastewater Characterization for Wash/Rinse Waters generated during field Investigation

- * Split Sample: A sample which has been portioned into two or more containers from a single sample container or sample mixing container.
- * Duplicate Sample: Two or more samples collected simultaneously into separate containers from the same source under identical conditions.
- * Background Sample: A sample collected for an area, or site similar to the one being studied, but located in an area known or thought to be free from pollutants of concern.
- * Biased Sample: A sample which is known to be non-representative of the entire site being studied. An example is samples collected during Superfund Site Screening Investigations that are intentionally biased towards suspected areas of contamination.
- * Trip Blanks: Trip blanks are prepared prior to the sampling event in the actual sample container and are kept with the investigative samples throughout the sampling event. They are then packaged for shipment with the other samples and sent for analysis. At no time after their preparation are the sample containers to be opened before they reach the laboratory.
- * Equipment Blanks: Equipment field blanks are defined as samples which are obtained by running organic-free water over/through sample collection equipment after it has been cleaned. These samples will be used to determine if cleaning procedures were adequate. (The equipment could have been cleaned in the field or prior to the field operation.)
- * Field Blanks: Organic-free water is taken to the field in sealed containers and poured into the appropriate sample containers at predesignated locations. This is done to determine if any contaminants present in the air may have had an effect on sample integrity. Field blanks should be collected in dusty environments and/or from areas where volatile organic contamination is present in the atmosphere and originating from a source other than the source being sampled.

2.5.3 General Considerations

These factors and procedures have been considered in view of specific objectives and the scope of this field investigation.

Selection of Sampling Sites

Sampling sites are chosen so as to characterize the site as effectively

as possible.

Selection and Proper Preparation of Sampling Equipment

The types of sampling equipment to be used is dictated by the investigation and is discussed for each medium later in this section.

Sampling Equipment Construction Material

The material of which sampling equipment is constructed can affect sample analytical results. Materials used must not contaminate the sample being collected and must be readily cleansed so that samples are not cross-contaminated.

Selection of Parameters to be Measured

Parameters to be measured are selected based on previous sampling investigations and knowledge of past operations conducted at the Saad Site. The Analytical Program Summary is included as Table 2.5.1.

Required Sample Volumes

The volume of sample obtained should be sufficient to perform all required analyses with an additional amount collected to provide for quality control needs, split samples, or repeat examinations.

The amount of sample required for analyses planned for the field investigation are shown in Table 2.5.2.

The sample volume required for each analysis is the volume of the standard container less ullage (empty space) required for sample mixing by laboratory personnel and safe shipment of samples to the laboratory. Personnel shall allow a minimum of ten percent ullage in every sample container for this purpose. The only exception being samples collected for purgeable organic analyses (VOA) for which sample containers must be completely filled.

TABLE 2.5.1
ANALYTICAL PROGRAM SUMMARY

Sample Matrix	Number of Sample Locations	Trip Blank	Blind Duplicates	Matrix Spike Duplicates	Field Measurements	Sample Location	Analytical Parameters
Soil Borings	7 locations 1-2 samples/ location	1 per sample shipment	1 per 10 samples	1 per 20 samples	Total VOC*	Figure 5-1	TAL/TCL, geotechnical
Surface Soils	2 at OWS excavation				Total VOC	Excavation Pit	TAL/TCL
Trench Soils	4 maximum				Total VOC	Trenches	TAL/TCL
Air	1 per hour				H&S monitoring	Excavation pit & borings	Organic vapors
Decon Rinse Water	1 per batch					Drums and/or tanks	TAL/TCL
Exposed Drum Contents	1 per drum or segregated group of drums					Each drum type	per TSDF directive
Ensite Drums	1 per drum or segregated group of drums					Each Drum Type	per TSDF directive
Decon Water	1 per batch					Drums and/or plastic tanks	per POTW or TSDF directive
OWS Contents	1 composite						BTEX, TRPH, TOX, TCLP (as required by TSDF)

*Organic Vapor Analysis on every split spoon

TABLE 2.5.2
SAMPLE CONTAINERS, PRESERVATIONAL HOLDING TIMES

Parameter	Container	Preservation	Holding Time	Reference
Metals (solids)	8-oz. widemouth glass w/Teflon lined closure	cool, 4°C	6 months	1
Extractable Organics (solids)	8-oz. widemouth glass w/Teflon lined closure	cool, 4°C	14 days	1
Other Inorganics (CN ⁻) (solids)	8-oz. widemouth glass w/Teflon lined septum sealed caps	cool, 4°C	Not specified	1
Purgeable Organics (liquids)	2-oz. VOA container w/Teflon lined septum sealed caps	cool, 4°C	14 days	1
Petroleum Hydrocarbons	8-oz.	cool, 4°C	28 days	Appendix II Attachment C
BTEX	8-oz.	cool, 4°C	7 days	Appendix II Attachment C
TCLP	8-oz.	cool, 4°C	7 days	Appendix II Attachment C

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Selection and Proper Preparation of Sample Containers

The type of sample container is dictated by the analyses required. Standard sample containers are presented in Table 2.5.2.

Sample Preservation

Samples for some analyses must be preserved in order to maintain their integrity. Preservatives required for routine analyses of samples are given in Appendix II, Attachment C, Table 5-2.

All samples preserved with chemicals shall be clearly identified by indicating on the sample tag that the sample is preserved. If samples normally requiring preservation were not preserved, field records shall indicate why.

Sample Holding Times

The elapsed time between sample collection and initiation of laboratory analyses must be within a prescribed time frame for each individual analysis to be performed. Sample holding times for all samples to be collected are shown in Appendix II, Attachment C, Table 5-2.

Sample Handling and Mixing

After collection, all sample handling should be minimized. Field personnel should use extreme care to ensure that samples are not contaminated. Samples will be placed in an ice chest and personnel should ensure that melted ice cannot cause sample containers to become submerged, as this may result in sample cross-contamination. Plastic bags, such as Zip-Lock bags, will be used when small sample containers are placed in ice chests to prevent cross-contamination.

Once a sample has been collected, it may have to be split into separate containers for different analyses. A true split of soil, sediment, or

sludge samples is almost impossible to accomplish under field conditions. The higher the moisture content, the more difficult it is to split the sample. It is extremely important that soil samples be mixed as thoroughly as possible to ensure that the sample is as representative as possible of the sample interval. To ensure uniformity, the soil in the sample pan will be divided into quarters. Each quarter will be mixed, then all quarters will be mixed into the center of the pan. This procedure will be followed several times until the sample is adequately mixed. Soil samples to be analyzed for volatile organic compounds will not be mixed.

Sample Identification

All samples will be fully documented in the field records, on the field sample Chain-Of-Custody Record, and on the sample labels.

Procedures for Identifying Potentially Hazardous Samples

Any sample either known or thought to be hazardous should be so identified on both the sample tag and field sample Chain-Of-Custody Record. Information explaining the hazard, i.e., corrosive, flammable, poison, etc., shall also be listed.

Collection of Auxiliary Data

All auxiliary data such as photographs of sampling sites, meteorological conditions, and other observations shall be entered onto the field records when the auxiliary data are collected. Auxiliary data relative to a particular sampling location should be collected as close to the sample collection time as possible. Specific types of auxiliary data to collect for each medium sampled are discussed later in this section.

Time Records

All records of time shall be kept using locate time in the 2400 hour time format and shall be recorded to the nearest minute.

Transporting and Shipping of Samples

Samples will be hand delivered to the laboratory.

Sample Chain-Of-Custody

Project team member will maintain sample chain-of-custody during all field investigations for all samples collected. The standard sample chain-of-custody procedures and forms are found in Appendix II, Attachment C.

2.5.4 Sampling Techniques

The following sampling techniques will be employed during the course of the field Investigation to characterize the Saad Site:

1. Soil - Boring and Trenching
2. Drums - Grab Samples and Composite Liquid Samples (in the case of unknown liquids found in drums)
3. Wastewaters - Grab Samples of each batch of wastewater

Soil

A Description of soil boring and trenching methodology can be found in Section 5.0, "Soil Sampling Investigation Plan."

Drums

Samples of both open and closed drums may be required during the field investigation.

A problem which often arises in drum sampling is stratification and/or phase separation of the container contents. When this condition occurs, or is suspected, care will be taken to insure that the sample collected is representative of the container contents. If only one layer or phase is

sampled, this will be noted and taken into account when interpreting analytical results.

If stratification is not present, samples will be composited by depth (i.e., collected throughout the entire depth of the container or at several different depths) to provide a representative sample. When a drum is standing vertically, depth compositing provides a good quantitative basis. Samples will not be composited across containers.

Sampling Equipment

The following equipment will be available for use in collecting waste samples from open and closed drums: a complete set of spark-resistant (beryllium-brass) tools including barrel bung wrenches, adjustable wrenches, etc.; coliwasa samplers for drum sampling; glass tubes for drum sampling; and a peristaltic pump for liquid waste sampling from containers.

Sampling Techniques

Closed drums, containing unknown materials or known hazardous materials will be opened using only spark proof opening devices and while the container is grounded.

The most commonly used sampling device for 55-gallon drums is the coliwasa sampler. The coliwasa sampler is a single use glass sampler, consisting of an outer glass tube with one end tapered, and a separate inner glass tube with a small bulb on one end. In use, the outer tube is slowly lowered into the drum, tapered end first. This must be done slowly for two reasons. One, the drum may contain solid materials which might break the tube and injure the sampler. Second, slowly lowering the tube allows the liquid phases in the drum to stay in equilibrium with the coliwasa sampler, ensuring a representative sample. The inner glass tube is inserted (bulb end

first) into the outer tube. In the latter case, the bulb tip of the outer tube must be pulled back several inches from the tapered end of the outer tube. After both inner and outer tubes are inserted into the drum to be sampled, the inner tube bulb end is pressed gently against the tapered end of the outer tube, forming a seal. Both tubes are withdrawn from manipulating the inner tube, the sampler can control the rate of flow of the sampled liquid into the sample container.

Samples from drums may also be collected using a four-foot length of glass tube. Glass tubes with a 1/2-inch or less inside diameter will be used. The tube will be sealed either with the thumb or a rubber stopper to hold the sample in the tube while removing the tube from the container. The sample will then be placed in the appropriate container, and the procedure is repeated until an adequate amount of sample is collected. Sample volume will be held to the absolute minimum required for analysis.

Wastewaters

Wastewaters and rinse waters generated during the field investigation will be sampled batch-wise for the purpose of characterization. The local POTW will be contacted to verify the proper analytical requirements. It is anticipated that at a minimum a representative batch of waste water will be analyzed for pH, BTEX, TRPH, and TCLP hazardous constituents. If that batch demonstrates that POTW discharge standards will not be exceeded, subsequent batches generated from identical operations will be assumed to demonstrate similar characteristics. The handling, treatment, and disposal options will be evaluated at that point. Previous field investigations have been performed using an on-site filtration, activated carbon absorption

system to process waste waters prior to off-site transport to a hazardous waste disposal company for further treatment.

The following options will be considered for the handling of wastewater:

1. Direct discharge to the sanitary sewer
2. Transport of each batch of wastewater to a licensed wastewater treatment facility
3. Sand filtration and carbon treatment on-site followed by either discharge to the sewer or transport off-site to a licensed wastewater treatment facility.

Further evaluation of the disposal option available for wastewater generated during the field investigation will be conducted prior to the initiation of the Work Plan tasks in order to avoid extensive on-site storage of batches of wastewater. All disposal activities will be approved by the EPA OSC.

2.5.5 Sample Collection Quality Control

Measurement of Relative Sampling Precision

The following duplicate sampling procedures shall be used during the collection of samples as a relative measure of the precision of the sample collection process. One duplicate grab and/or composite sample will be collected during the investigation. This sample will also be collected at the same time, using the same procedures, the same equipment, and in the same types of containers as the required sample. It will also be preserved in the same manner and submitted for the same analyses as the required sample.

2.5.6 Chain-of-Custody Procedures

General

The possession of samples or other physical evidence shall be

traceable from the time they are obtained until they are submitted to the analytical laboratory.

Sample Custody

A sample or other physical evidence is in custody if:

- * It is in the field investigator's or the transferee's actual possession; or
- * It is in the field investigator's or the transferee's view, after being in his/her physical possession; or
- * It was in the field investigator's or the transferee's physical possession and then he/she secured it to prevent tampering; or
- * It is placed in a designated secure area.

Chain-of-Custody Record

The Chain-Of-Custody Record is used to record the custody of all samples.

The following information must be supplied in the indicated spaces in detail to complete the field Chain-Of-Custody Record.

- * The project name.
- * All samplers and/or sampling team leader must sign in the designated signature block.
- * The sampling number, date, and time of sample collection, grab or composite sample designation, and a brief description of the type of sample and the sampling location must be included on each line (each line shall contain only those samples collected at a specific location).

2.6 DRILL CUTTINGS AND EXCAVATED SOILS

During sampling and trenching activities, potentially contaminated soils and cuttings will be produced. After the trenching exploration has been completed, all soils will be replaced in the trench. Plastic sheeting will be placed at the base of the trench to delineate the extent of the excavation during future excursions. Small volumes of soil cuttings will be

produced during the boring activities. These cuttings will be collected at the end of the boring activities, placed in a bermed area and covered with polyethylene plastic. Final disposal of potentially contaminated cuttings will be handled when (and if) remediation of the Site is required. Upon completion of all soil borings, the Site will be cleaned of trash and excess soil. Excess soil will be spread evenly around the immediate area of the Site so that the ground surface will be returned to its original contours. The bore holes will be sealed with grout at the conclusion of boring activities.

2.7 SURVEY

At the conclusion of the boring activities, a survey of bore holes will be conducted to accurately locate the position of all borings and sampling locations. Test boring will be surveyed to an accuracy of 0.1 feet for vertical control. The horizontal position of each boring will be denoted on the existing survey plat and included in any future report documents.

3.0 REMOVAL AND DISPOSAL OF OIL/WATER SEPARATOR SYSTEM

3.1 INTRODUCTION

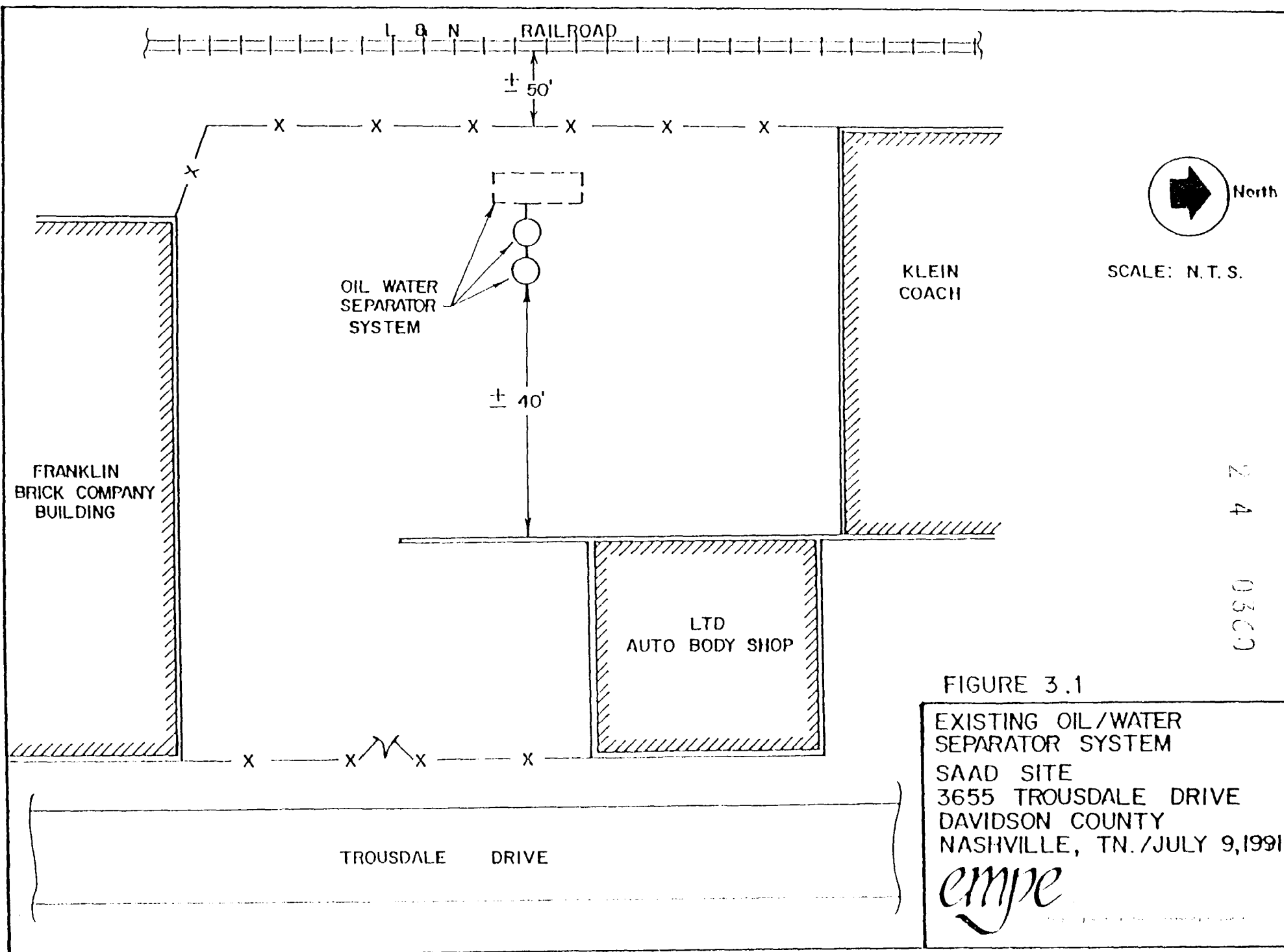
This section provides the plan and procedures for the removal of the oil/water separator (OWS) and any associated piping and equipment at the Saad Trousdale Drive Site. The OWS will be removed as a safety precaution and also to provide access for sampling of site soils. In order to safely and effectively sample and characterize the soils at the rear of the Site, the OWS will be excavated, decontaminated, and disposed. Previous remedial actions conducted by Ensight, Inc. in 1990 have effected the removal of the original liquids and sludges, and the cleaning of the interior of the containment vessels.

3.2 DESCRIPTION OF THE EXISTING SITUATION

A schematic diagram of the OWS system is shown as Figure 3.1. Although the exact size and piping arrangement of the system is not known, the approximate description given to EMPE by Ensight personnel familiar with the Site is as follows:

- * There are two five-foot diameter cylinders placed in the ground, oriented with the major axis vertical, connected by pipes. The estimated depth of the cylinders is 6 feet.
- * A larger flow-through 5000-gallon vessel is also connected to the system and is located to the west of the aforementioned cylinders.

The former contents of the entire system were pumped out in the summer of 1990 by Ensight and the interior of the OWS system was spray cleaned. The contents included both solids and liquids which were subsequently disposed with the liquids being processed through an on-site sand and activated carbon filtration/adsorption system and later



transported to the wastewater treatment system at OSCO, Inc. in Columbia, Tennessee for further biological and chemical treatment.

At the present time, the OWS is covered with a larger 15 foot diameter circular steel cap to prevent ingress of surface materials, e.g. storm water and silt. Since the steel cap does not form an absolute seal, contingency is provided in this plan for removal of any materials discovered in the system.

3.3 EQUIPMENT REQUIREMENTS

The following list describes the equipment which will be on-site for the removal of the OWS:

- * Trackhoe (40,000 lb)
- * Rubber tired backhoe/front end loader
- * Pickup truck and/or van
- * Lifting straps and chains
- * Combustible gas indicator
- * Two (2) portable plastic 500-gallon liquid storage tanks
- * Two (2) submersible electric pumps (explosion proof)
- * Steam Jenny for decontamination and cleaning
- * Eight (8) rolls of 6 mil polyethylene sheeting
- * Mobile telephone
- * Oxygen/acetylene cutting torch
- * Tripod and safety harness for possible vessel entry
- * Self Contained Breathing Apparatus
- * Three (3) 55-gallon open top drums
- * Three (3) 55-gallon closed top drums

The Contractor will ensure that the equipment described above along with all other equipment, materials, and documents required by the Health and Safety Plan and the Sampling Plan associated with this project are on-site prior to the initiation of any activities.

3.4 POTENTIAL HAZARDS AND SITE SAFETY

A more detailed description of safety and health hazards associated with the Site can be found in the Site Safety Plan appended to this Work Plan.

The specific hazards resulting from the excavation/removal of the OWS are construction related hazards:

- * Lifting heavy equipment using chains and straps
- * Trenching collapse
- * Equipment operation in close quarters
- * Slip, trip, fall hazards
- * Welding, cutting, and brazing hazards
- * General construction hazards
- * Confined space entry

All work performed on the Site will be in accordance with OSHA regulations, the Site Safety Plan, and all other work plans relating to the several activities previously described. The Site Safety Officer will ensure safety compliance and will have the authority to stop work activities at any time that he feels that there is a threat to human health and/or safety which is inadequately addressed, that there is a violation of the OSHA regulations, or that the Work Plan or Site Safety Plan is not being followed.

3.5 WORK SEQUENCE

The following tasks are described according to the approximate sequence of performance beginning with gaining access to the OWS system and finishing with the

disposal of the system as steel scrap:

Preliminary

1. The OWS area will be continuously monitored with a combustible gas indicator and photoionization detector to ensure that hazardous vapor concentrations do not occur.
2. The steel cap over the OWS will be removed using the trackhoe bucket and lifting chains.
3. The OWS system will be checked for contents. If there are contents, they will be pumped into a steel storage tank or 55-gallon drum for characterization and eventual disposal.

Excavation

4. The upper 2 feet of soil surrounding the vessel walls will be excavated and moved to a staging area away from the excavation. This soil will be kept separate from other soil removed from the excavation pit since previous investigations have demonstrated that the shallow soils contain a lower concentration of volatile organic compounds. For this reason the shallow soils will be used as final cover when the OWS removal has been completed.
5. Additional soil will be removed to expose the exterior tank wall and allow removal of the OWS system components. This soil will be staged adjacent to the excavation on polyethylene and will be placed back in the pit after the OWS has been removed.
6. The vessels will be lifted from the excavation pit with the trackhoe and moved to an area at the rear of the property where decontamination and dismantling can take place.

Excavation Pit

7. If liquids fill the excavation pit after the OWS is removed, they will be pumped into the portable storage tank for characterization and eventual disposal.
8. Soils at the base of the pit and along the walls will be sampled according to the Soil Sampling Plan (Section 5.0).
9. After soil sampling is completed, it will be necessary to backfill the pit to prevent ponding. The deeper soils staged adjacent to the pit will be placed back into the pit over a layer of polyethylene. This layer of polyethylene will delineate the extent of the excavation for any future

activities in this area.

10. After Step 9 the area will be graded with the goal of filling the remainder of the pit. The final fill layer will be the upper 2 feet of shallow soils previously removed and staged.

OWS System Decontamination, Dismantling, and Disposal

11. The interior and exterior vessel walls will be cleaned to remove all visible residues. Steam cleaning will be required to remove viscous or oily material. All liquids created during the cleaning operation will be contained and stored in a portable plastic tank for characterization and eventual disposal.
12. The components of the OWS system will be dismantled, disassembled, and cut into smaller transportable sections with an oxygen/acetylene cutting torch. The sections of scrap metal will be removed from the Site as soon as possible to allow the soil sampling to proceed.

Equipment Decontamination and Termination

13. All equipment used during this project will be containerized for eventual disposal or it will be decontaminated with a steam jenny. All gloves, Tyvek suits, and other non-reusable items will be properly disposed.
14. All liquids produced during performance of this portion of the project will be containerized, characterized, and disposed. Depending on the characteristics of the liquids, it is anticipated that they will be disposed of in the sanitary sewer after the acquisition of the appropriate sewer use permit from the local publicly owned treatment works (POTW).

4.0 CHARACTERIZATION AND MANAGEMENT/DISPOSAL OF ON-SITE DRUMS

4.1 INTRODUCTION

During previous visits to the Saad Trousdale Drive Site in Nashville, Tennessee, the presence of exposed drums has been noted just off the western boundary of the Saad property. According to available information, these drums may be classified into two categories: Category 1) drums generated during a previous Site characterization and removal activities conducted at the Site; and Category 2) drums and other drum bones lying just off the western edge of the Site which were uncovered or partially exposed by the owners/operators during their previous excavation activities.

Category 1 drums contain spent carbon and sand and personal protective equipment (PPE) generated during the removal and treatment of liquids formerly contained in on-site storage tanks. These removal activities were conducted by Ensite, Inc. in 1990 pursuant to the Administrative Order by Consent and were overseen by the EPA OSC or his representative. Ensite has been requested to provide EMPE with information pertaining to the contents of these drums.

Category 2 drums are unknown with regard to specific origin and contents. These drums have not been examined during initial investigations at the Site. From a distance, these appear to be partially crushed and buried and corroded to some degree. At this time, the exact number of Category 2 drums is not known since some drums of this type may be exposed when surface drums are removed. It is not currently known whether these drums contain any residues or other material.

4.2 DRUM CHARACTERIZATION

4.2.1 Category 1 Drums

As stated previously, these drums were generated during removal activities conducted at the Site. Initially, these drums should be counted so that an accurate

number can be established. Next, two scenarios are possible with regard to the identification, characterization and classification of the material contained in these drums. For a detailed depiction of the steps proposed for the characterization, classification and disposal of these drums, see the decision tree included in this report as Figure 4.1. A more detailed depiction of the steps required for choosing a disposal option is included as Figure 4.2.

Scenario 1

Information provided by Ensite regarding the on-site drums will be reviewed. If the information regarding the contents of these drums is sufficient to adequately characterize and classify these drums disposal options will then be selected. Initially, the most cost effective disposal options consistent with the regulations applicable to the contents of the drums will be determined with the concurrence of the USEPA OSC, an option(s) will then be selected for disposal and a profile sample will be obtained for the waste management facility. Also, as soon as the chemical constituents of the drums are identified, the drums will be marked and/or labeled appropriately in order to achieve compliance with applicable regulations and to simplify any subsequent segregation of the drums into subgroups.

Scenario 2

If the information provided by Ensite proves insufficient or if Ensite is unable to provide the information, sampling of the Category 1 drums will be necessary for characterization. In order to accomplish this, the drums will be segregated into categories based upon the observed contents of each. A representative sample will be taken from a drum in a given category. (Note: All samples will be acquired in accordance with EPA Region IV Standard Operating Procedures (SOPs) Quality Assurance protocol and also in

DECISION TREE FOR CHARACTERIZATION/ CLASSIFICATION OF CATEGORY 1 DRUMS

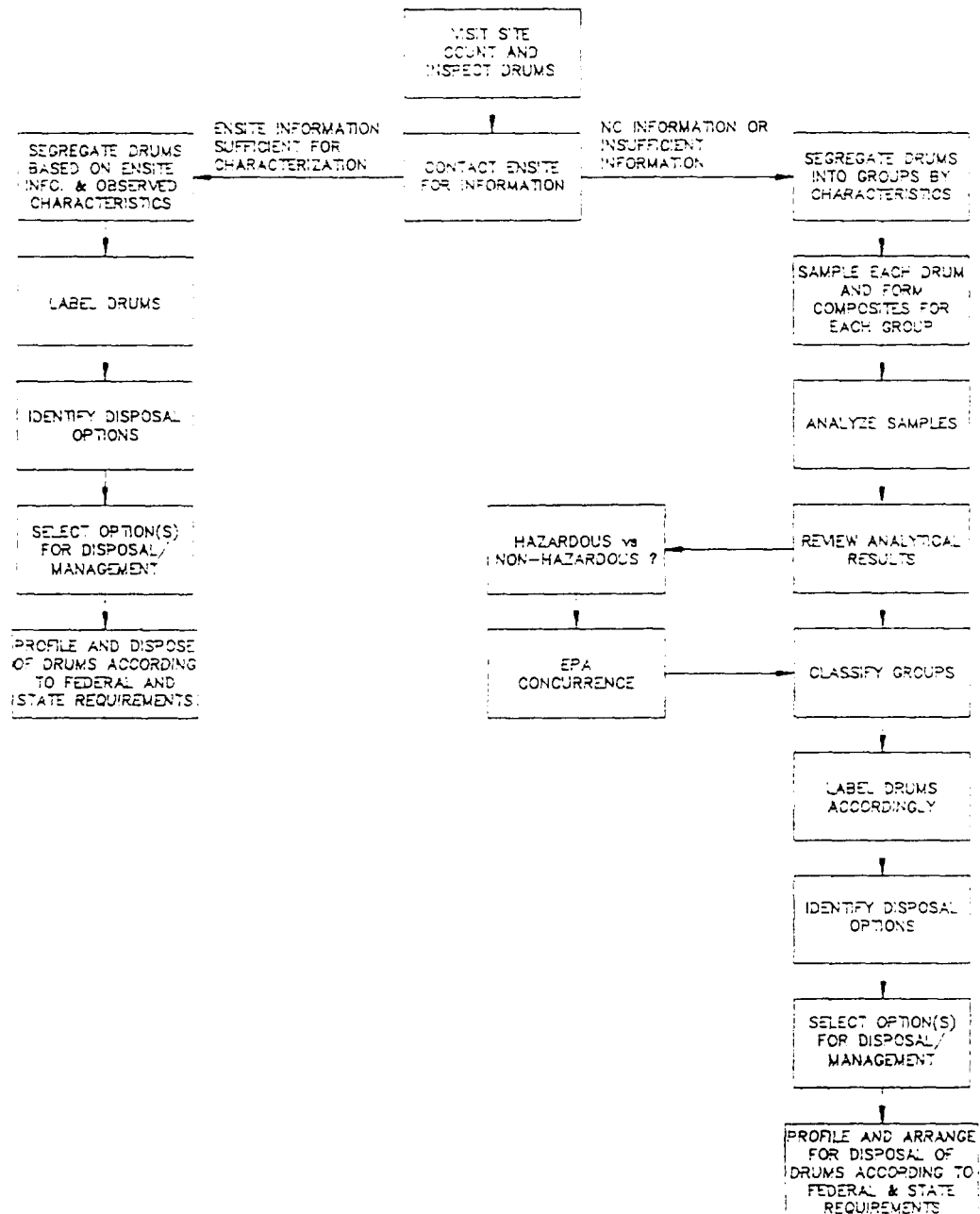


FIGURE 4.1

STEPS FOR CHOOSING A DISPOSAL OPTION

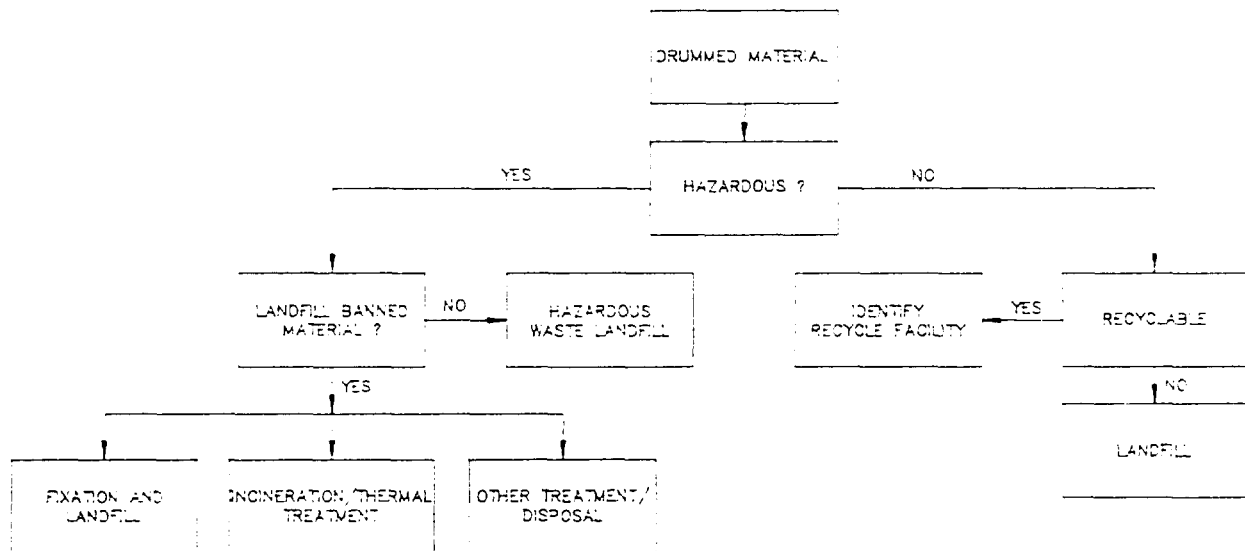


FIGURE 4.2

adherence to safety procedures set forth in the site safety and health plan developed for on-site activities.) Each of these resultant samples will then be transported to the analytical laboratory where the list of selected analyses necessary for characterization of the material will be performed. Some or all of the analyses listed in Table 4.1 of this work plan may be required for characterization of drummed material.

Upon receipt of the analytical results, the determination will be made as to the nature (hazardous or non-hazardous) of the drummed material and the drums will be labeled, profiled, and a list of disposal options compiled as described in Scenario 1. With the concurrence of the USEPA OSC, an option or options will be selected for the permanent disposal/management of Category 1 drums in accordance with all Federal and State requirements.

4.2.2 Category 2 Drums

As stated previously, the actual origin and contents (if any) of Category 2 drums is not known at this time. Initially, the actual number of Category 2 drums will be verified by close inspection.

As with the drums in Category 1, two scenarios are possible with regard to classifying and identifying disposal options. For a detailed description of these, see the decision tree included in this work plan as Figure 4.3. The two identified scenarios are generally described below.

Scenario 1

It is possible that, upon closer inspection, it will be discovered that exposed drum remains contain no discernable material. If this is the case, these may be classified as "empty" as defined in 40 CFR 261.7. These drums may then be crushed and placed in either overpack drums or in a roll-off type container and, with concurrence of USEPA, disposed of as non-hazardous waste.

DECISION TREE FOR CHARACTERIZATION/ CLASSIFICATION OF CATEGORY 2 DRUMS

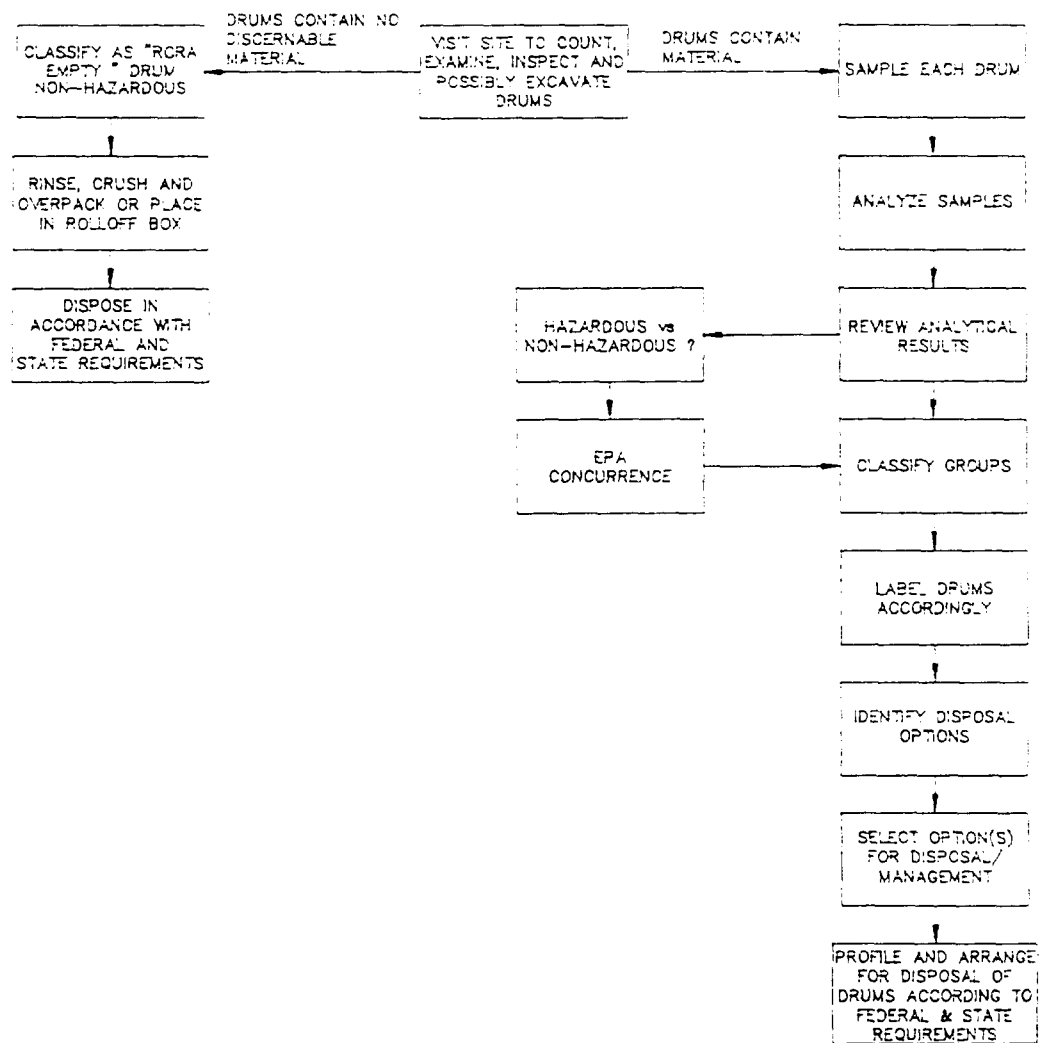


FIGURE 4.3

Scenario 2

If some or all of the Category 2 drums are found to contain material, a representative sample will be taken from each of the drums containing material. These samples will be acquired and handled in accordance with the procedures set forth in Section 2.5 of this Work Plan. Samples taken from these drums will be analyzed for some or all of the parameters listed in Table 4.1 as required by potential disposal firms for completion of waste profile characterizations.

Upon receipt of the analytical results, the drums will be profiled, over packed and labeled according to the characteristics of each. A list of disposal options will then be developed for the drums. An option or options will be selected for the permanent disposal/management of the Category 2 drums with the concurrence of the USEPA and in accordance with all Federal and State requirements.

4.3 DRUM HANDLING

During all handling of drums or sampling of drummed material, safety equipment and personal protective equipment will be used as described in the site safety and health plan. Additionally, the handling and movement of drums will be minimized to the greatest extent practical and will be conducted in accordance with requirements set forth by the Occupational Safety and Health Administration (OSHA) in 29 CFR 1910.120(j).

4.4 SPILL PREVENTION AND RESPONSE

Handling and movement of drums will be conducted in a controlled and safe manner in order to minimize the potential for damage to sound containers or the potential for releases of material from damaged containers. If a leak or spill occurs, any material released will be contained using surrounding soil or an appropriate absorbent media and the remaining contents of the leaking container will be placed in another drum and/or the

damaged drum will be over packed. Also, any soil or absorbent material used to contain a spill or release will be disposed in compliance with applicable State and Federal requirements. If a release of a reportable quantity of a hazardous substance as defined in 40 CFR Part 302.4 should occur, the appropriate agencies will be contacted as detailed in Attachment E of the Health and Safety Plan.

4.5 CONTAINERIZATION OF MATERIAL

All drums which contain solids and are not intact will be placed in DOT-approved 85 gallon overpack drums for temporary storage.

Any waste liquids requiring storage will be transferred into DOT-approved bung-top drums of either 55 or 30 gallon capacity for temporary storage.

4.6 DRUM SAMPLING

Representative samples from drums containing liquid will be collected with a drum thief or similar device. Samples from drums containing solid material will be collected with a sample auger or similar instrument. All sampling will be conducted in compliance with EPA Region IV SOPs.

TABLE 4.1

LIST OF ANALYTICAL PARAMETERS AND METHODS

<u>Parameter</u>	<u>Method</u> (SW-846 # unless otherwise indicated)
TCLP Extraction	1311
Pesticides	8080
Herbicides	8150
Semi-Volatile Compounds	8270
Volatile Organic Compounds	8240
TCLP Metals	7000 series
pH	9040/9045
Total Organic Halogens	ASTM D808-81/D2361-85
Cyanide	9010
Sulfide	9030
Flash Point	1010
Polychlorinated Biphenyls (PCBs)	8080
Total Recoverable Petroleum Hydrocarbons	9071
Benzene, Toluene, Ethylbenzene and Xylene (BTEX)	8020

5.0 SOIL SAMPLING INVESTIGATION

The purpose of the soil sampling and analysis plan is to provide a framework for the investigation of the physical extent of the former settling basin and the nature and extent of any contamination occurring in the soils of the vadose zone at the Site. The soil sampling plan contains information related to the type of sampling, location of samples, sample frequency, and sample handling. Sampling techniques and procedures as well as analytical methods and QA/QC requirements are described in the Quality Assurance Project Plan in Appendix II and in Sampling Procedures, Section 2.5.

5.1 SAMPLING OBJECTIVES

The work scope developed is based on the recommendations in the Trenching Report (EMPE, July 1991) and is designed to confirm results of previous investigatory activities and to provide additional characterization. The objectives of this soil sampling investigation are the following:

1. Determine the approximate boundaries of the former settling basin;
2. Characterize the nature of any contamination within the settling basin; and
3. Determine the nature of any contamination on the site.

The investigation of the extent of contamination at the site consists of the following components:

- * Trenching to determine the approximate boundaries of the former settling basin;
- * Confirmatory borings for the settling basin boundaries;
- * Boring and trench sampling to determine the nature of any contamination associated with the settling basin;
- * On-site borings with continuous split spoon sampling to determine lithologies and geotechnical characteristics;
- * Chemical characterization of boreholes; and
- * Sampling of soils associated with the removal of the oil/water separator system.

The type of sampling, the location and rationale, and the number of samples for each of the bulleted items are addressed in the following sections. Approximate sampling locations are presented in Figure 5.1

5.2 INVESTIGATION OF THE EXTENT OF THE FORMER SETTLING BASIN

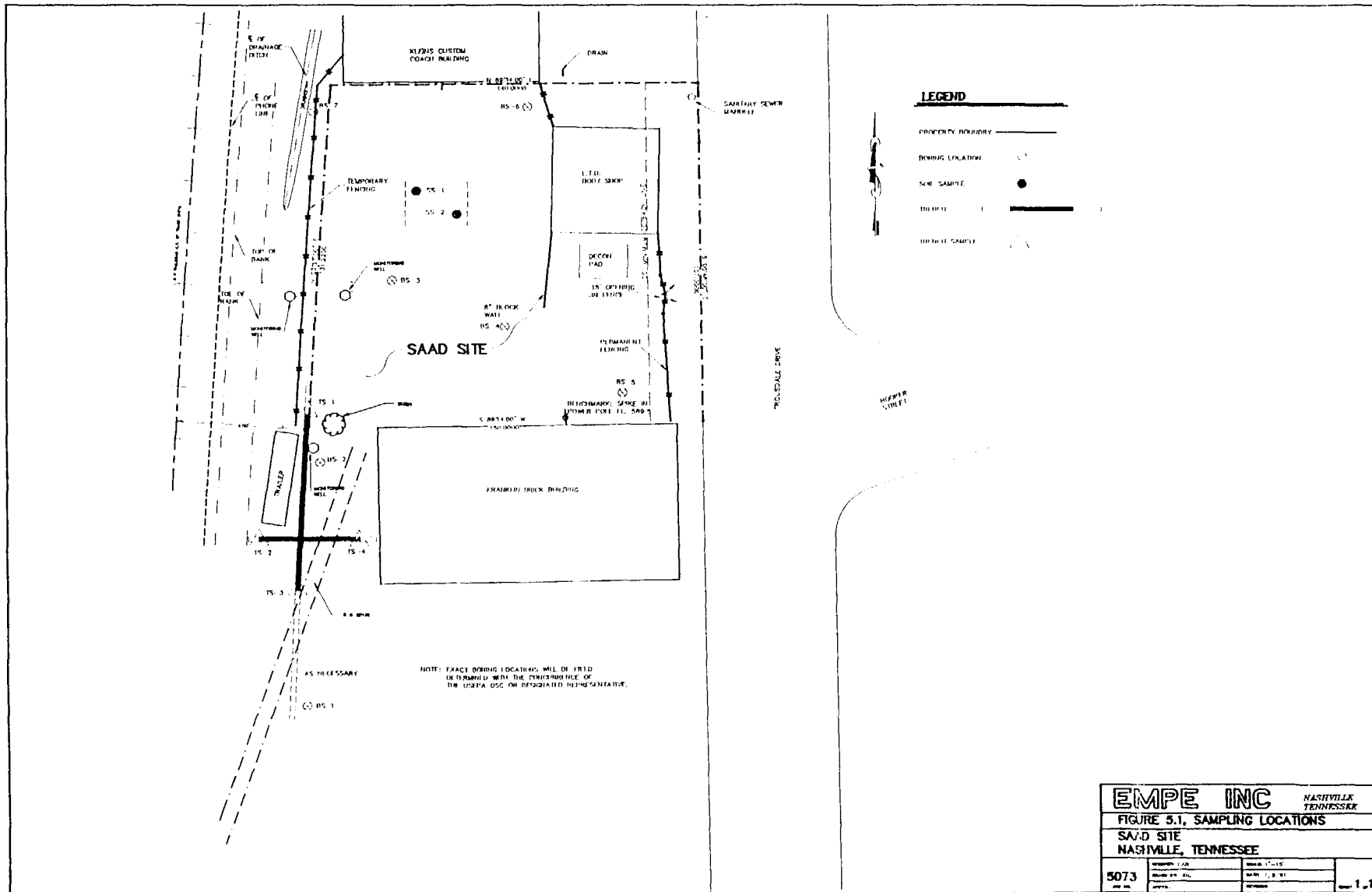
A trackhoe will be utilized to dig trenches in an east-west and north-south direction over the former settling basin tentatively delineated by historic aerial photographs. The east-west trench will extend from the Franklin Brick Building to the berm of the CSX railroad line. The rail line will not be removed in order to complete the east-west trench. The north-south trench will extend south from the area where the EMPE Trenching Investigation (March 1991) was conducted to the apparent limits of the settling basin.

The trenching will be conducted to a depth of the equipment limits, bedrock or the water table. If near surface water is encountered, vertical trenching will cease but horizontal trenching will continue. The presence of near surface water may be indicative of the former settling basin.

Soil samples may be collected from the settling basin during trenching operations to determine the nature of any contamination. These samples will be collected at the locations identified on Figure 5.1 or based on observed Field conditions at the discretion of the on-site geologist in conjunction with the EPA-OSC or his representative. A maximum of 4 samples will be collected during trenching activities. In addition, confirmatory samples will be collected from soil borings at the periphery of the settling basin as defined by the trenching operations.

5.2.1 Soil Boring Program

Hollow stem auger borings will be advanced into the subsurface at locations identified in Figure 5.1. Continuous split spoon sampling will be utilized to obtain lithologic information, and collect soil samples for chemical and geotechnical analyses.



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Split spoon samples will be collected until auger refusal, bedrock, or groundwater is encountered. A maximum of two samples per borehole will be collected for chemical analysis. Split spoon samples will be screened with a photoionization detector and visually observed for geologic logging purposes. All samples will be collected in conformance with EPA Region IV protocol.

In addition, two soil samples will be collected from the pit associated with the removal of the oil/water separator system. These samples will be collected with the trackhoe bucket from opposite sides of the pit.

5.2.2 Safety Procedures for Drilling Activities

The designated safety person shall be responsible for the safety of the team performing the drilling activities. All personnel conducting drilling activities shall be qualified in proper drilling and safety procedures. Before any drilling activity is initiated, the area shall be surveyed with the necessary detection equipment to locate, flag or mark, all underground utilities such as electrical lines, natural gas lines, fuel tanks and lines, water lines, etc. Before operating the drill auger, a pilot hole will be dug (with hand equipment) to a depth of two to three feet to check for undetected utilities or buried objects. Drilling will proceed with caution until a safe depth is reached where utilities normally would not be buried. The following safety requirements shall be adhered to while performing drilling activities.

- * All drilling personnel shall wear safety hats, glasses, and steel toed boots. Ear-plugs are required and shall be provided by the safety officer.
- * Work gloves (cotton, leather, etc.) shall be worn when working around or handling drilling equipment.
- * All personnel directly involved with the drilling rig shall know where the kill switches are located in case of emergencies.

- * Do not hold any part of the safety hammer assembly while taking standard penetration tests or while the hammer is being operated.
- * Do not lean against the drill rig or place hands on or near moving parts at the rear of the rig while it is operating.
- * Keep the drilling area clear of any excess debris, tools, or drilling equipment.
- * Do not climb on the drilling rig while it is being operated or attempt to repair the rig while it is being operated. The driller shall direct the work on the rig.
- * Do not move or pickup any drilling equipment unless directed by the driller and/or the project leader.
- * Each drill rig shall have a first-aid kit, and fire extinguisher located on the rig quickly accessible for emergencies.
- * Work clothes shall be firm fitting, but comfortable and free of straps, loose ends, strings etc., that might catch on some moving part of the drill rig.
- * Rings or other jewelry shall not be worn while working around the drill rig.
- * The drill rig shall not be operated within a minimum distance of 20 feet of overhead electrical power lines and/or buried utilities that might cause a safety hazard. In addition, the drill rig shall not be operated while there is lightning in the area of the drilling site. If an electrical storm moves in during drilling activities, vacate the area until it is safe to return.

5.3 ANALYTICAL PARAMETERS

Analytical protocols, sampling procedures, sample handling procedures, and QA/QC requirements are described in the QAPP (Appendix 2). All soil samples listed in Table 2.5.0 that are to be collected during trenching and boring operations will be analyzed for the Target Compound List (TCL) Target Analyte List (TAL), which includes volatiles, semi-volatiles, PCBs, pesticides and metals.

Selected soil samples will be analyzed for geotechnical parameters, including permeability, cation exchange capacity, grain size distribution, porosity, density, pH and moisture content. This data is necessary for evaluation of applicable remedial technologies.

5.4 SAMPLE HANDLING

Sample handling procedures for the soil sampling investigation as well as general information on sampling protocol can be found in Section 2.5, Sampling Procedures.

6.0 STORM WATER REDIRECTION EVALUATION

A preliminary storm water drainage evaluation has been conducted for the Trousdale Drive area in the immediate vicinity of the Saad Site. The drainage routes and topographical contours are shown in Figure 6.1. "Storm Water Runoff".

As a part of the storm water evaluation, EMPE personnel performed a survey to obtain relative elevations on-site using a level, level rod, and surveyors chain. Also, the Site was inspected immediately after a storm event to verify the actual drainage patterns and characteristics.

The Site is gently sloped (the range of elevations is less than 2 feet) to drain off-site in two directions. One-half of the Site drains west toward the swale located at the base of the steep bank below the railroad. The other half drains in sheet runoff east toward Trousdale Drive. A small, depressed area is located near the center of the property. During storm events, a small amount of rainwater remains standing in the center of the Site. Runoff from the Site generally appears to flow toward Seven Mile Creek.

According to Mike Murdock of the Metropolitan Nashville-Davidson County Storm Water Department, ponding and other storm water runoff problems along Trousdale Drive have existed for many years. Mr. Murdock indicated there is no storm water drainage plan for the Trousdale Drive area.

The Klein's Custom Coach building appears to have been constructed in a depression with the first floor elevation 2 to 3 feet lower than the first floor elevation of other buildings in the area. Also, the front of the Klein's Custom Coach property is a depressed concrete driveway receiving the storm water runoff from the area along Trousdale Drive and to the north. This driveway contains culverts/drains that are clogged with soil. The culverts along Trousdale Drive are almost completely clogged, adding to the drainage problem. The drainage trench at the rear of Klein's Custom Coach property

drains the northwestern corner of the Saad property along with the roof runoff from the rear of the Klein's Custom Coach building.

This preliminary storm water redirection evaluation has concluded that recontouring of the Site to effect storm water drainage is unnecessary. Storm water drainage problems appear to be endemic to the area and, as a result, the surface elevations and contours on the Saad property do not significantly affect the drainage characteristics of the Trousdale Drive area. However, storm water drainage redirection will be examined as a function of the remedial alternatives evaluation.

7.0 REMEDIAL ALTERNATIVES ANALYSIS

The purpose of the remedial alternatives analysis is to identify response actions and technologies that may be applicable after additional information concerning the site has been determined from the upcoming investigation/removal activities. The appropriate remedial alternatives will be based upon an evaluation of important factors concerning the volume, consistency and hazardous characteristics of any contaminated soils found on site.

Based on information available at the present time, a variety of remedial alternatives may be appropriate for this site. The exact alternative or combination of alternatives will be determined after the Site has been adequately characterized. At a minimum, the following list of remedial options/technologies will be considered:

No Action

Institutional Action

Access Restrictions
Deed Restrictions
Monitoring

Containment Action

Capping
Vertical Barriers
Horizontal Barriers
Surface Controls

Treatment Action

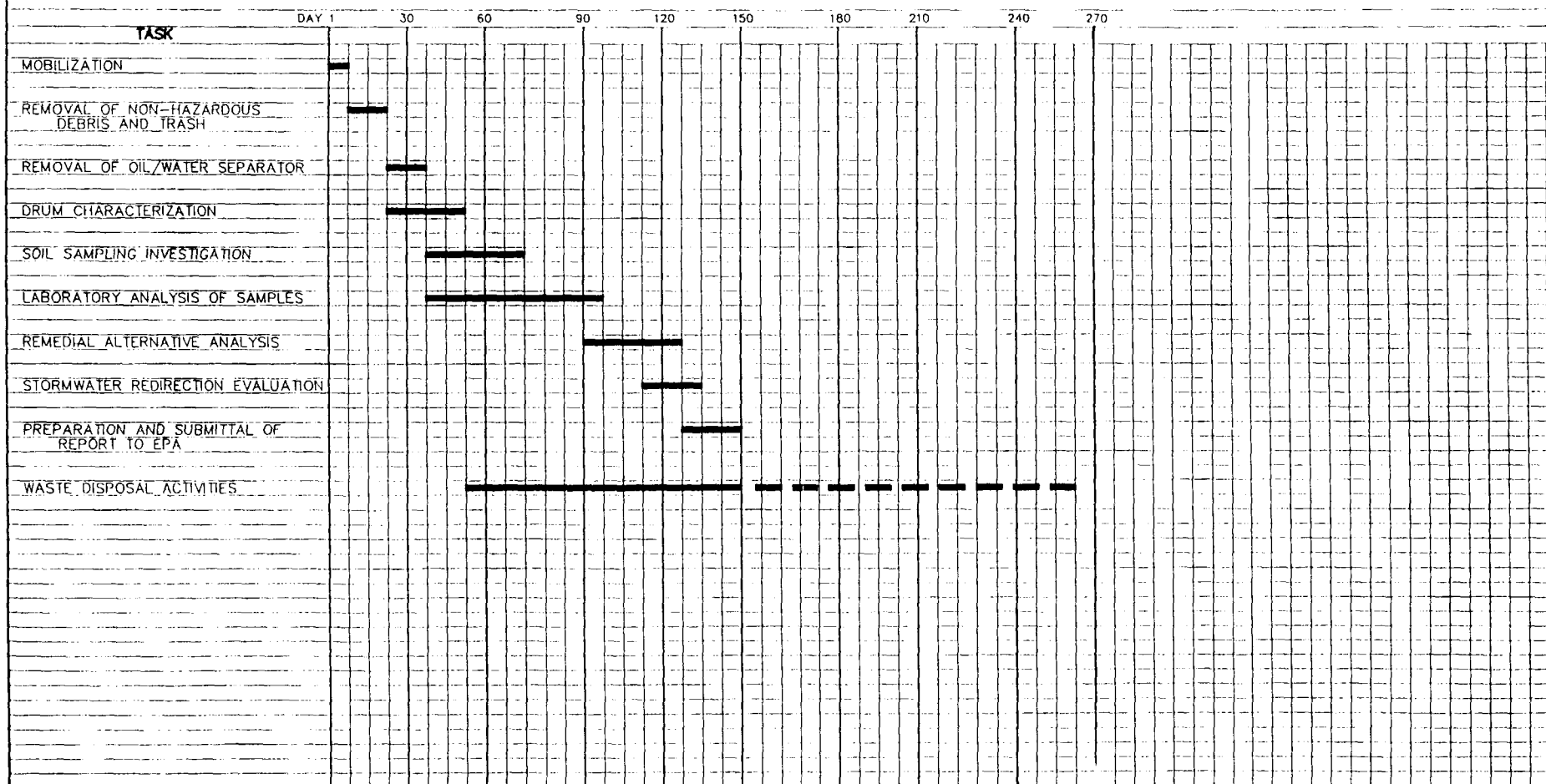
Bioremediation
Excavation
Stabilization
Solidification
Physical Treatment
Chemical Treatment
Thermal Treatment
Soil Venting/Vacuum Extraction

8.0 SCHEDULE OF REMOVAL ACTION/FIELD INVESTIGATION WORK PLAN TASK

The schedule of performance for the Work Plan Task is shown on the following page. Approximately 150 days will be required to perform all Work Plan tasks not including complete characterization and disposal of waste liquids generated during the investigation. The time required to dispose of the waste materials will depend on the characteristics of the waste and the regulatory requirements relating to those characteristics, and it should be noted that the schedule begins upon acquiring access agreements from the owners of the appropriate properties and approval of the Work Plan by USEPA. The schedule will be adjusted in accordance with any delays caused by force majeure.

SCHEDULE OF REMOVAL ACTION/FIELD INVESTIGATION WORKPLAN TASKS

empe, INC.



NOTES: • DAY 1 IS THE DATE OF RECEIPT OF WRITTEN APPROVAL OF THE WORKPLAN FROM EPA AND ACQUISITION OF ALL NECESSARY SITE ACCESS AGREEMENTS.
 --- WASTE DISPOSAL CONTINGENT UPON FINDINGS FROM WASTE MATERIALS CHARACTERIZATION, DISPOSAL FACILITY REQUIREMENTS AND BACKLOGS.

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APPENDIX I
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN
FOR
REMOVAL ACTIONS/FIELD INVESTIGATION
AT THE
SAAD TROUSDALE DRIVE SITE

3655 TROUSDALE DRIVE
NASHVILLE, TENNESSEE

JULY 1991

Submitted to:

United States Environmental Protection Agency
Region IV

Prepared by

EMPE, Inc.

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I. INTRODUCTION

This plan has been developed to provide a written health and safety program for activities associated with the investigation and remediation of the Saad Trousdale Drive Site (hereinafter referred to as "the Site") in Nashville, Tennessee. The health and safety of site workers and the public is a primary concern during hazardous materials investigations. Thus, a comprehensive, carefully managed, and documented Health and Safety Plan is crucial for project completion. An area map of the Site is included as Figure 1 of this report while a Site schematic is included as Figure 2.

This Health and Safety Plan details specific responsibilities, training requirements, protective equipment, operating procedures, emergency procedures, and medical monitoring requirements associated with site activities. This plan also describes the health and safety guidelines which have been developed to protect personnel on-site (Site workers, inspectors, and approved visitors). These guidelines are based on information that is available prior to beginning on-site work and are subject to change should monitoring carried out during on-site work indicate the need for such changes. Any such changes will be documented and justified in the Site Safety Log, a sample page from which is included in Attachment A.

II. HEALTH AND SAFETY CONSIDERATIONS

A. Personnel Awareness

Site workers, inspectors and approved visitors will be apprised of the nature of the work being done and the nature of existing and potential hazards prior to Site entry. The complete Health and Safety Plan will be discussed with all site personnel prior to beginning work and will be made available for review through the Site Managers. A list of all compounds detected during the most recent investigation of the Site is included in Attachment B along with a description of each. Also, a list of

safety-related equipment which will be available on-site is included in Attachment C.

The medical facility located nearest the Site is Southern Hills Medical Center at 391 Wallace Road. The location of this facility is indicated on Figure 1 of this report.

All personnel entering the Site will acknowledge having received this information by signing the Worker Certification, a sample page from which is included in Attachment D of this plan.

B. Training

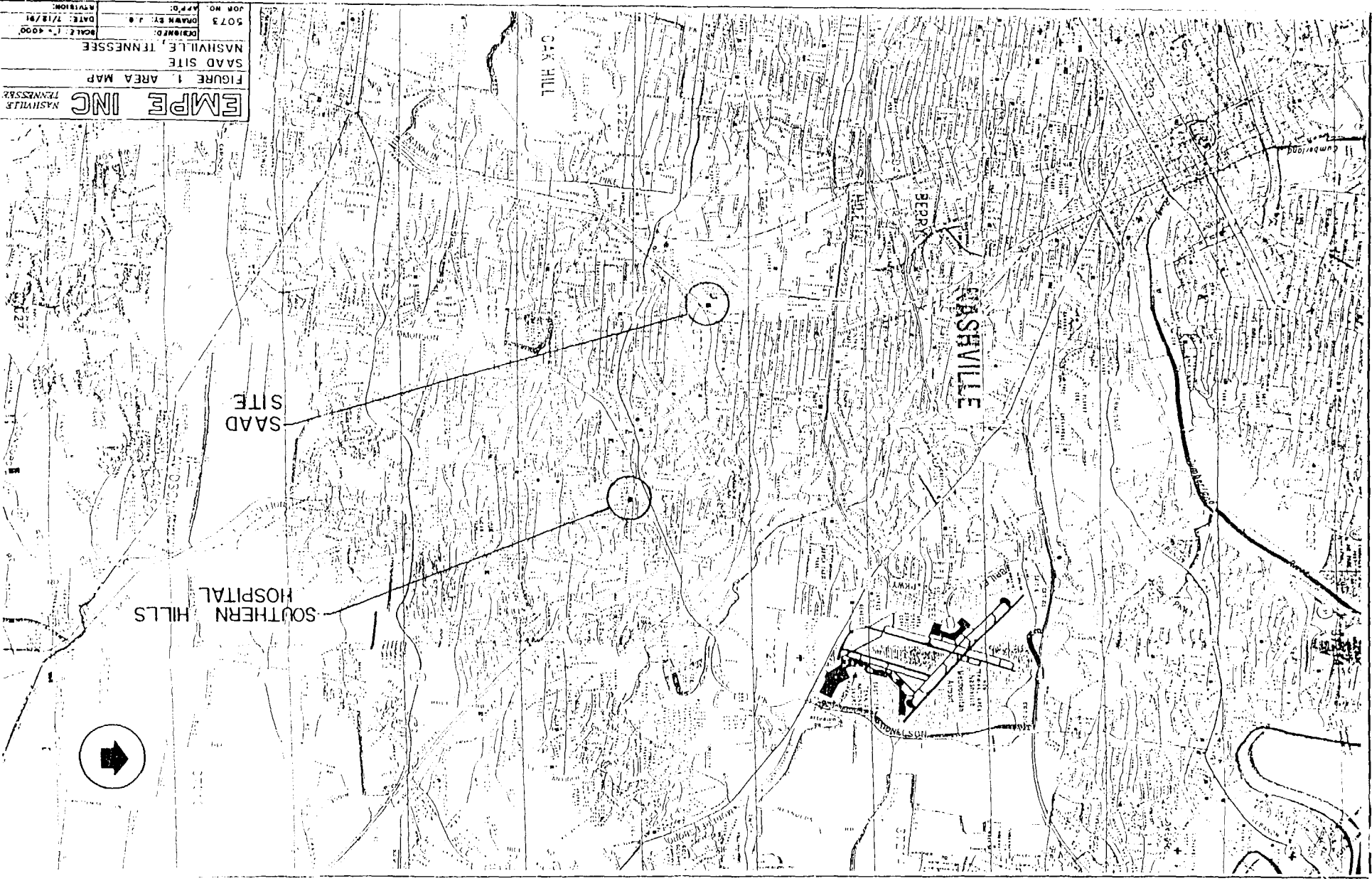
All personnel (including subcontractors) who are assigned work duties at the Site will certify that they have met the OSHA requirements through experience or specific training as required by 29 CFR 1910.120(e)(3). This certification is included on the "Worker Certification Page" included in Attachment D of this plan. Personnel who have not met the requirements of the regulations or are unwilling to sign the certification will not be allowed entry to the Site. Visitors or other personnel will not be allowed in the work zone unless they have received the required OSHA training.

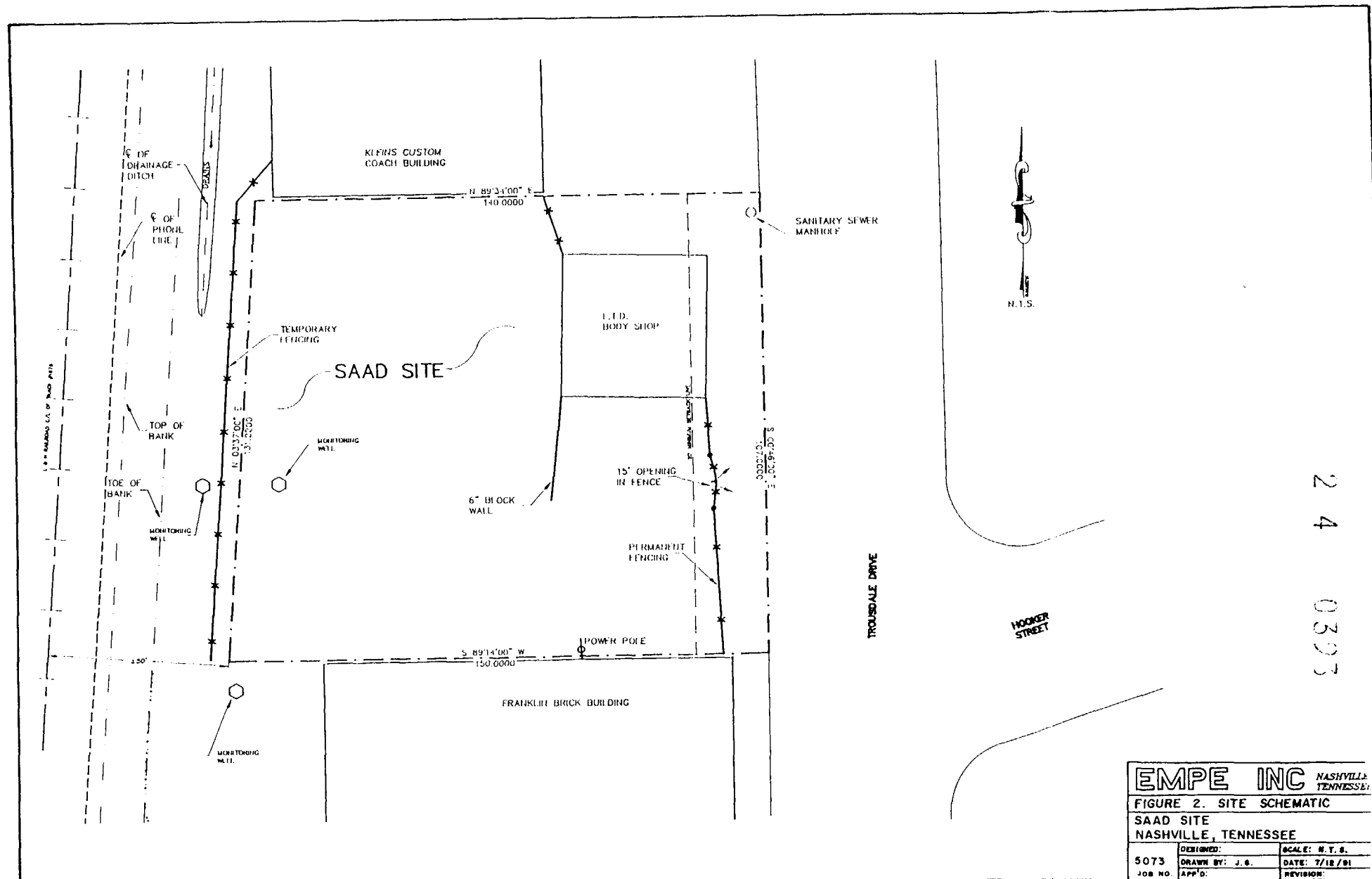
C. Safety Officer

The Project Manager, or an individual designated by him, will serve as the Safety Officer for the project and will be identified by name in the Safety Log. The Safety Officer will be responsible for implementation of the safety program described in this plan. The duties of this position include: maintaining the Safety Log; supervising or carrying out atmospheric monitoring; safety briefings of all workers and visitors; determining the level of PPE that is required; controlling entry and exit access to the Site; monitoring workers before and during work to ensure their suitability for performing their assigned tasks; and maintaining general

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NASHVILLE, TENNESSEE	
FIGURE 1 AREA MAP	
SAAD SITE	
NASHVILLE, TENNESSEE	
5073	DATE: 7/18/91
5073	DATE: 7/18/91
5073	DATE: 7/18/91





EMPE INC		
NASHVILLE, TENNESSEE		
FIGURE 2. SITE SCHEMATIC		
SAAD SITE		
NASHVILLE, TENNESSEE		
DESIGNED:	SCALE: N.T.S.	
5073	DRAWN BY: J.S.	DATE: 7/18/81
JOB NO.	APP'D:	REVISION:

observation of all on-site activity to ensure the safety plan is being adhered to and watching for potentially unsafe situations.

D. Safety Meetings

A morning briefing will be held at the beginning of each work day to reiterate safety practices, state protective equipment needed for the day's activities and review the work planned for the day. A debriefing will be conducted at the end of each day to assess progress, discuss problems which were encountered, and to plan on-site activities for the following day.

E. Communications

The Site will comprise a small area with a clear view all around; therefore, elaborate communications systems will not likely be necessary. Routine communications will be conducted verbally and may be amplified by bull horn if necessary. Simple emergency hand signals for "stop digging", "shut off all power", and "withdraw from the area" will be arranged and reviewed in morning briefings. A portable compressed air horn will be readily available to the Safety Officer at all times and will be used as a signal for emergency evacuation.

A mobile telephone will be kept on-site during all exploratory activities and can be used to summon assistance as needed. A list of emergency phone numbers is included in this report in Attachment E and will be kept at the work Site near available telephones.

F. Visitors

Approved visitors to the Site will adhere to the same safety and training requirements as work crews. They must present themselves to the safety officer, be identified in the Safety Log as a visitor and sign the Visitor Certification, an example page from which is included in this plan in Attachment F, acknowledging that they are aware of the hazards posed by the Site. **Visitors will utilize the level of protective clothing and respiratory protection consistent with the portion of the Site**

he/she intends to visit. This level of protection will be consistent with the requirements of the portion of the Site being visited, not the convenience of the visitor. Visitors will properly decontaminate upon exiting the work Site.

G. Personnel Protection

It is important that personal protective equipment and safety requirements be appropriate to protect against the potential or known hazards at an incident. Protective equipment will be selected based on the type(s), and concentration(s) of hazardous substances and the potential routes of personal exposure from substances at the Site.

Previous analyses of soil samples have shown the presence of several organic compounds in various concentrations in the subsurface. Continual monitoring for the presence of organic vapors will be carried out during all excavational and/or boring and drilling activity. This monitoring will be performed with a photoionization detector supplemented with direct reading colorimetric tubes and an explosimeter/oxygen meter and will normally take place in the "work zone". The work zone is considered the area within a twenty foot radius of any on-site activity. This zone is specified as such because it is the area in which workers are most likely to be exposed to elevated levels of vapors brought to the surface through disturbance of the soil.

Work at the Site will begin in Level D PPE. Continual air monitoring to identify and quantify airborne levels of hazardous substances and health hazards will be carried out during all work activities to determine the appropriate level of employee protection needed. Routine air monitoring will be performed prior to commencement of on-site work in order to establish background levels. These background levels will be developed each day and noted in the safety log. Monitoring will be accomplished with an HNu photoionization detector supplemented with direct reading colorimetric tubes and an explosimeter/oxygen

meter. These instruments will be used to detect organic vapors and will be maintained and calibrated as specified by the manufacturer.

The level of PPE will be upgraded to Level C if vapors detected in the work zone exceed 10 ppm for five minutes or longer. In the event that vapors detected in the work zone exceed the IDLH for any of the known compounds, workers will be withdrawn and a two-man team outfitted in Level B will enter the work zone to monitor the atmosphere to determine if the levels have dropped sufficiently to allow workers to resume work in Level C. Subsequent information may suggest changes in the original level selected.

H. Personal Protective Equipment Rationale

Level B Protection

Level B Personal Protective Equipment will be utilized when the types and concentrations of hazardous substances are known and require the highest degree of respiratory protection but exposure to the small unprotected areas of the body (i.e. neck and back of head) is unlikely or when concentrations are known to be within acceptable exposure standards.

Level B will be worn when:

1. Immediately Dangerous to Life and Health (IDLH) atmospheres are indicated. (The IDLH value for a given compound is defined as the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.)
2. Types and concentrations of vapors in the air do not present a hazard to the small, unprotected areas of the body.
3. Atmospheres with concentrations of known substances greater than protection factors associated with full-face air-purifying respirators.
4. Atmospheres with less than 19.5% oxygen.

Level B PPE includes:

1. Full face, positive pressure supplied air breathing apparatus either SCBA or airline.
2. Hooded chemical resistant suit.
3. Chemical resistant gloves (inner and outer).
4. Disposable, chemical resistant outer boots.
5. Steel toe and steel shank inner boots.
6. Hard hat.

Level C Protection

Level C protective equipment will be utilized when the types and concentrations of hazardous substances are known and can be adequately addressed with air purifying respirators and exposure to the few unprotected areas of the body is unlikely to cause harm. Level C protection will be worn when:

1. Known materials have adequate warning properties.
2. Air concentrations of known materials do not require a protection factor greater than that afforded by a full-face air purifying respirator - 50 x Threshold Limit Value-Time Weighted Average (TLV-TWA) concentration. (The TLV-TWA for a given chemical is defined as an average concentration to which all workers may be repeatedly exposed for a normal 8-hour workday and 40-hour workweek without adverse effect.)
3. Proper respirator cartridges are available.
4. Dermal exposure to unprotected areas of the body is nonexistent or less will cause harm.
5. Continuous air or personnel monitoring is carried out during on-site activities.

Level C PPE consists of:

1. Full face, air purifying chemical cartridge respirator with appropriate cartridges.

2. Hooded chemical resistant suit.
3. Chemical resistant gloves (inner and outer).
4. Disposable, chemical resistant outer boots.
5. Steel toe and steel shank inner boots.
6. Hard hat.

Level D Protection

Level D personal protective equipment is basic work clothing. Level D equipment will be worn when:

1. There are no olfactory indications of airborne health hazards present.
2. Continuous air or personnel monitoring will occur during on-Site activities.
3. No indications of airborne hazards above background are indicated by air monitoring instruments.

Level D equipment includes:

1. Work clothes/coveralls
2. Steel toe and steel shank boots.
3. Hard hat.
4. Safety glasses, safety goggles, or face shield.

Level D equipment may be augmented with disposable coveralls, outer boots, and gloves.

The area within a 30-foot radius of the "work zone" will be designated as the support zone. The "support zone" will contain equipment necessary for the decontamination of personal safety equipment, such as work boots, and drums in which contaminated disposable equipment, such as gloves, may be placed for safe containment and disposal. The "support zone" will also contain a shaded rest area, seats, and fluids for Site personnel if prolonged operations are being conducted.

I. Decontamination

Decontamination of personnel and equipment will be implemented in order to minimize the spread of contamination and control personnel exposure to contaminants.

Specific decontamination procedures will be implemented as deemed appropriate for each specific on-site activity; at a minimum, all disposable items (gloves, coveralls, sampling equipment, etc.) will be drummed, labeled and disposed properly. If deemed necessary by the Site Safety Officer or Project Manager, a formal decon line with equipment drop and contaminant reduction stations for washing and removal of PPE garments will be implemented.

At the completion of the work, the Safety Officer will visually inspect all equipment used for digging or soil sampling to ensure that these are clean before leaving the facility. Additionally, all respirators used at the Site will be sanitized daily or after each use.

J. General Safety Practices

There will always be a minimum of two people on Site during work activities. No one is to perform field work alone. Direct communication will be maintained at all times.

Contact with contaminated or potentially contaminated surfaces is to be avoided. Site personnel will not sit, lean, or stand on contaminated equipment, containers or other surfaces or walk through puddles or discolored areas.

Eating, drinking, chewing gum or tobacco, or smoking will be permitted only in designated areas away from the work zone.

Site workers will carefully wash face, hands, and forearms upon leaving the work zone and before eating or drinking.

No facial hair which interferes with the satisfactory fit of respiratory protection is allowed on personnel required to wear such equipment. Each staff

member must pass fit-test for the respirator to be worn in the field.

All instructions given by the Safety Officer will be followed at all times. Site workers will report any and all accidents to the Safety Officer, regardless of severity.

A list of hazards that may conceivably be encountered on-site and the planned standard operating procedures (SOP) prescribed for contending with each hazard is included below.

K. Specific Hazards or Incident and Standard Operating Procedures

Hazard: Chemical Exposure

SOP: Ensure that proper PPE is used and upgraded as necessary; if exposure occurs, consult reference documents on-site for first aid procedures and seek medical attention as soon as possible.

Hazard: Cold Stress

SOP: Ensure Site workers are properly attired with clothing adequate to protect them from cold; provide heated shelter for break area; know treatment and watch for the symptoms of frost nip, frost bite, and hypothermia; if practical, erect wind breaks/deflectors.

Hazard: Heat Stress

SOP: Provide sufficient break/cool down periods for level of PPE being used, provide shaded break area, provide drinks for replenishment of body fluids and materials (do not use salt tablets), monitor for symptoms of heat stress through visual observations and taking and recording vital signs (pulse, temperature), know treatment and watch for symptoms of heat rash, heat cramps, heat exhaustion, and heat stroke.

Hazard: Electrical Power

SOP: Ensure OSHA standards for electrical power are adhered to, have ground fault circuit interrupter on all circuits in use at the Site, have "dead man stick" available to move people or power lines.

Hazard: Slip, trip, and fall

- SOP: Keep work area free of trip hazards, be aware of surroundings and activities taking place in them, provide sufficient lighting during low light conditions (i.e. early morning, early evening, and night).
- Hazard: Low light
- SOP: No operations will be conducted during low light conditions for this project.
- Hazard: Splashes from chemical compounds
- SOP: Use proper PPE (i.e. safety glasses, face shield, gloves, coveralls, etc.); know the locations of emergency eyewash stations.
- Hazard: Drum handling
- SOP: Drums will be used to contain contaminated PPE and other disposables. Drum handling will be in accordance with OSHA regulations (29 CFR 1910.120 (j)).
- Hazard: Heavy equipment operations
- SOP: Minimize number of persons working around moving equipment, maintain direct communication with the operator, equip machinery with back-up warning devices, use only properly trained operators.
- Hazard: Heavy rain and thunderstorms
- SOP: Stop work, shut down non-essential equipment, seek shelter out of drainage-ways and away from lightning attractors (trees, backhoe, power poles, etc.).
- Hazard: Fire
- SOP: Conduct operations to minimize risk of fire, use non-sparking tools whenever appropriate; have appropriate class(es) of fire extinguishers available at the Site; do not refuel equipment that is in operation; ground equipment, fuel cans, and drums of flammable materials. If fire occurs on-site, respond defensively if practical and alert the fire department; if fire is uncontrollable with available equipment, evacuate to a safe distance.

SPECIFIC HAZARDS ASSOCIATED WITH EXCAVATION AND/OR DRILLING:

Hazard: Utilities, buried and overhead

SOP: Survey area prior to setting up, avoid locations with overhead utilities if possible, use safety spotter to watch drilling tower if drilling must be done in close proximity to overhead utilities, utility companies will be consulted prior to on-site activities for information regarding locations of buried utilities; these will be marked for continual reference.

Hazard: Flying debris from damaged excavation equipment

SOP: Pay attention to stresses that, being placed on equipment, could result in breakage; ensure all Site workers know the location for "kill switches" on all heavy equipment.

Hazard: Confined space entry

SOP: Monitor confined space to verify that combustible gases are less than 10% of the lower explosive limit (LEL) and that oxygen levels are between 19.5% and 22%; sides of pits or excavations deeper than 5 feet must be supported against collapse prior to entry; always maintain a standby to watch anyone entering a confined space; use PPE appropriate to atmosphere in confined space.

L. Medical Monitoring Program

A medical monitoring program will be established for each individual working at the site. Initially, each individual will be required to undergo and pass a comprehensive physical examination prior to beginning work. Subsequently, the monitoring program will continue on an annual basis.

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ATTACHMENT A

SITE SAFETY LOG

Project: Location: Date: _____ Sheet ____ of ____

Personnel: Safety Officer Others:

Known Hazards:

Weather:

SITE ACTIVITIES - Include instruments used, calibration, instrument readings, injuries, PPE in use, visitors, etc.

TIME

ACTIVITIES

ATTACHMENT B

KNOWN ON-SITE CHEMICALS AND SELECTED CHARACTERISTICS

NOTE: The chemicals listed below have been identified in samples taken from soil and water at the Site. However, most of these compounds were only detected in trace levels and contact with these chemicals in high concentrations is not anticipated.

Information regarding chemical characteristics included in this list was taken from Hawley's Condensed Chemical Dictionary, 11th Edition; Rev. by N.I. Sax and R.L. Lewis, Sr. All TLV-TWA information was taken from the 1990-1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices compiled by the American Conference of Governmental Industrial Hygienists (ACGIH). All IDLH and exposure symptom information was taken from the National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards - 1990.

Ethylbenzene (CAS # 100-41-4)

Properties: Colorless liquid, aromatic odor, vapor heavier than air, flash point = 59F

Hazards: Toxic by ingestion skin absorption and inhalation; irritant to skin and eyes; flammable

TLV: 100 ppm

IDLH: 2,000 ppm

Symptoms: Irritation of the eyes and mucous membranes; headache, narcosis and eventual coma

Toluene (CAS # 108-88-3)

Properties: Colorless liquid, aromatic odor, flash point = 40F

Hazards: Toxic by ingestion, inhalation and absorption; flammable

TLV: 100 ppm

IDLH: 2,000 ppm

Symptoms: Fatigue; weakness; confusion; euphoria; dizziness; headache; dilated pupils; lacrimation; nervousness; muscle fatigue; insomnia; parasthesia and dermatitis

Xylene (CAS # 1330-20-7)

Properties: Clear liquid, flash point = 81-115F

Hazards: Toxic by ingestion and inhalation, flammable

TLV: 100 ppm

IDLH: 1,000 ppm

Symptoms: Dizziness; excitement; drowsiness; incoordination; staggering gait; irritation of eyes, nose and throat; corneal vacuolization; anorexia; nausea; vomiting and abdominal pain

Tetrachloroethylene (or Perchloroethylene CAS # 127-18-4)

Properties: Colorless liquid, ether-like odor, flash point - none

Hazards: Irritant to eyes and skin; potential carcinogen

TLV: 50 ppm

IDLH: 500 ppm

Symptoms: Irritation of eyes, nose and throat; flushed face and neck; vertigo; dizziness; incoordination; headache; somnolence; skin erythema; liver damage

1,1-Dichloroethane (or Ethylene Chloride CAS # 75-34-3)

Properties: Colorless oily liquid, chloroform-like odor, flash point = 56F

Hazards: Toxic by ingestion, inhalation and skin absorption; strong irritant to eyes and skin, potential carcinogen; flammable

TLV: 10 ppm

IDLH: 4,000 ppm

Symptoms: Central nervous system depression; nausea; vomiting; dermatitis; irritation of eyes; corneal opacity

1,2-Dichloroethylene (CAS # 540-59-0)

Properties: Colorless liquid, pleasant odor, flash point = 39F

Hazards: Toxic by inhalation, ingestion and skin contact; irritant and narcotic in high concentrations; flammable

TLV: 200 ppm

IDLH: 4,000 ppm

Symptoms: Irritation of eyes and respiratory system; central nervous system depression

1,1,1-Trichloroethane (or Methyl Chloroform CAS # 71-55-6)

Properties: Colorless liquid, flash point - none

Hazards: Irritant to eyes and tissue

TLV: 350 ppm

IDLH: 1,000 ppm

Symptoms: Headache; lassitude; central nervous system depression; poor equilibrium; eye irritation; dermatitis and cardiac arrhythmias

Trichloroethylene (CAS # 79-01-6)

Properties: Colorless liquid, chloroform-like odor, flash point - none

Hazards: Toxic by inhalation; potential carcinogen

TLV: 50 ppm

IDLH: 1,000 ppm

Symptoms: Headache; vertigo; visual disturbance; tremors; somnolence; nausea; vomiting; eye irritation; dermatitis; cardiac arrhythmias and paresthesia

Vinyl Chloride (CAS # 75-01-4)

Properties: Compressed gas easily liquified, usually handled as liquid, ether-like odor, flash point = -108F

Hazards: Toxic by all routes of exposure; a carcinogen; highly flammable

TLV: 5 ppm

IDLH: none available

Symptoms: Weakness; abdominal pain; gastrointestinal bleeding; hepatomegaly; pallor or cyanosis of extremities

Phenol (CAS # 108-95-2)

Properties: White crystalline mass when not in solution, typically used in solution, distinctive odor, flash point = 172F

Hazards: Toxic by ingestion, inhalation and skin absorption; strong irritant to tissue

TLV: 5 ppm

IDLH: 250 ppm

Symptoms: Irritation of eyes, nose and throat; anorexia; weight loss; muscle aches and pains; dark urine; tremors; convulsions; twitching; dermatitis; ochronosis

Napthalene (CAS # 91-20-3)

Properties: White crystalline flakes, strong coal tar odor, flash point = 176F

Hazards: Toxic by inhalation

TLV: 10 ppm

IDLH: 500 ppm

Symptoms: Eye irritation; headache; confusion; excitement; malaise; nausea; vomiting; abdominal pain; irritation of the bladder; profuse sweating; jaundice; hemaglobunaria; renal shutdown and dermatitis

Phenanthrene (CAS # 85-01-8)

Properties: Colorless shining crystals when not in solution

Hazards: A potential carcinogen; combustible

TLV: none available

IDLH: none available

Fluoranthene (CAS # 206-44-0)

Properties: Colored needles when not in solution

TLV: none available

IDLH: none available

Petroleum Hydrocarbons (diesel fuel, motor oil, etc.)

Properties: Viscous liquid (depending on grade), unpleasant odor

Hazards: Toxic by ingestion; local skin irritant; moderate fire risk

TLV: none available

IDLH: none available

ATTACHMENT C

LIST OF ON-SITE SAFETY EQUIPMENT

Full-Face Respirators (x number of on-site workers)
Organic Vapor/Acid Gas and HEPA Respirator Cartridges (4x number of on-site workers)
Steel-Toe Safety Shoes/Boots
First Aid Kit
Eyewash Station
Safety Glasses (x number of on-site workers)
D.O.T. 17H55 Drums (2)
6 Millimeter Polyethylene Plastic (2 rolls)
Hard Hats
EMPE Van
Nitrile Gloves
Air Horn
Mobile Telephone
Fire Extinguisher
Water Cooler and Drinking Cups
HNu Organic Vapor Detector
Draeger Pump and Selected Detector Tubes
Explosimeter/Oxygen Meter
Brushes (2)
Plastic Decon Pools (2)
Detergent
Water Source (hose or tank if necessary)
Oral Thermometer
Blanket(s)
Chemical Exposure Contingency Reference
Self Contained Breathing Apparatus (2)
Tripod and Safety Harness

2 4 0411

ATTACHMENT D

HAZARDOUS WASTE SITE WORKER CERTIFICATION

I certify that I have been informed of the hazards associated with the Saad Site on Trousdale Drive, Davidson County, Tennessee, and that I have training or experience required by 29 CFR 1910.120.

[illegible]

2 4 0413

ATTACHMENT E

LIST OF EMERGENCY TELEPHONE NUMBERS/SITUATIONS

Emergency / emergency situation requiring fire department, police, or medical attention.....	911
Fire Department / fire or explosion or imminent threat of same	327-1300
Police Department / any emergency situation.....	862-7400
Coast Guard National Response Center / reportable quantity release of hazardous substance.....	1-800-424-8802
Tennessee Emergency Management Agency / reportable quantity release of hazardous substance, any significant emergency situation	741-0001
CHEMTREC / chemical information	1-800-424-9300
Poison Control Center / ingestion of chemical	322-6435
Tennessee Occupational Medicine / non-emergency exposure to chemical.....	321-4800
Utility One-Call / underground utility identification	366-1987
Southern Hills Medical Center / medical emergency	781-4600

2 4 0415

ATTACHMENT F

HAZARDOUS WASTE SITE VISITOR CERTIFICATION

I certify that I have been informed of the hazards associated with the Saad Site on Trousdale Drive, Davidson County, Tennessee. I agree to comply with directions given to me by the Safety Officer.

[illegible]

APPENDIX II
QUALITY ASSURANCE PROJECT PLAN
(QAPP)

QUALITY ASSURANCE PROJECT PLAN
FOR
REMOVAL ACTIONS/FIELD INVESTIGATION
AT THE
SAAD TROUSDALE DRIVE SITE

3655 TROUSDALE DRIVE
NASHVILLE, TENNESSEE

JULY 1991

Submitted by:

United State Environmental Protection Agency
Region IV

Prepared By:

EMPE, Inc.

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FIGURE 1 - PROJECT TEAM

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

The Work Plan to which this Quality Assurance Project Plan (QAPP) is appended has been developed to address conditions at the Saad Trousdale Drive Site (the Site) in Nashville, Tennessee. The purpose of this QAPP is to set forth documented procedures that will ensure the accuracy, precision and completeness of the data gathered by the Contractor during the investigatory activities described in this Work Plan. This plan addresses:

- Project staff organization and responsibility.
- The quality assurance (QA) objectives of the project.
- The quality assurance (QA) and quality control (QC) procedures that will be implemented in order to achieve the desired level of data quality.

The objectives of the QAPP are to ensure that the procedures used during on-site activities will not detract from the quality of the results and to ensure that all activities and subsequent findings and results adhere to the guidelines set forth in this QAPP.

1.2 ELEMENTS OF THE WORK PLAN

The major field elements of the Work Plan include provisions for the following exploratory and removal activities:

- Removal of oil water separator
- Characterization of drums
- Sampling of Site soils

These Work Plan elements have been designed for the performance of removal actions and investigatory activities that will comply with the Administrative Order by Consent dated April 11, 1990 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sections 104, 106(a) and 122.

1.3 SITE DESCRIPTION

The Site is an approximately one-half acre parcel of property located at 3655 Trousdale Drive in Nashville, Tennessee. During the 1970's and early 1980's, this site was occupied by an oil recycling business. The Site is currently occupied by an automotive body shop.

1.4 PROJECT OBJECTIVES

The objective of the on-site activities described in this Work Plan, as mentioned previously, is compliance with the requirements of the Order. More specifically, the objectives of this project are to:

- Gain information necessary to determine the nature and extent of any on-site soil contamination;
- Determine the extent of the former settling basin;
- Remove all impediments to the adequate characterization and (if necessary) subsequent remediation of the Site;
- Gain information necessary for evaluation of potential remedial alternatives and establish appropriate response levels; and to
- Provide for the greatest margin of personnel safety possible during the performance of all on-site activities.

The ultimate goal of all on-site activities is the eventual elimination or reduction of any hazard to the human health or the environment posed by the Site to a level determined to be acceptable by the Environmental Protection Agency.

1.5 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support EPA decisions during removal and/or remedial activities. DQOs must be considered when planning any study.

The DQO chosen for a given project will be dependent upon the intended use of the

data. Since this investigation is being conducted pursuant to a removal action under CERCLA 106, DQO Level IV quality data are unnecessary. DQO Level V procedures for decontamination and sampling will be utilized at the Site.

DQO Level V procedures are by definition non-standard and are not discussed in detail in EPA guidance documents. The field procedures proposed for implementation at this site are included in Sections 2.0 and 5.0 of the Work Plan.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

2.1 PROJECT ORGANIZATION

de maximis, inc. will serve as Project Coordinator for all Site-related activities while the Contractor is responsible for quality control of all on-site operations. Contractor personnel will conduct the required sampling, monitoring and documentation of on-site activities. The Contractor will also be responsible for auger boring, trenching and other heavy equipment operations. Figure 1 depicts the Project Team organization.

2.2 PROJECT RESPONSIBILITIES

For technical activities associated with this site, project organization is composed of the following personnel with the responsibilities indicated as follows:

- The Project Coordinator (PC) will serve as the primary contact point for the EPA On-Scene Coordinator and the PRP group. The PC will also be responsible for general oversight of all technical activities, on-site or otherwise, relating to this project.
- The Project Manager (PM) will be responsible for general management of

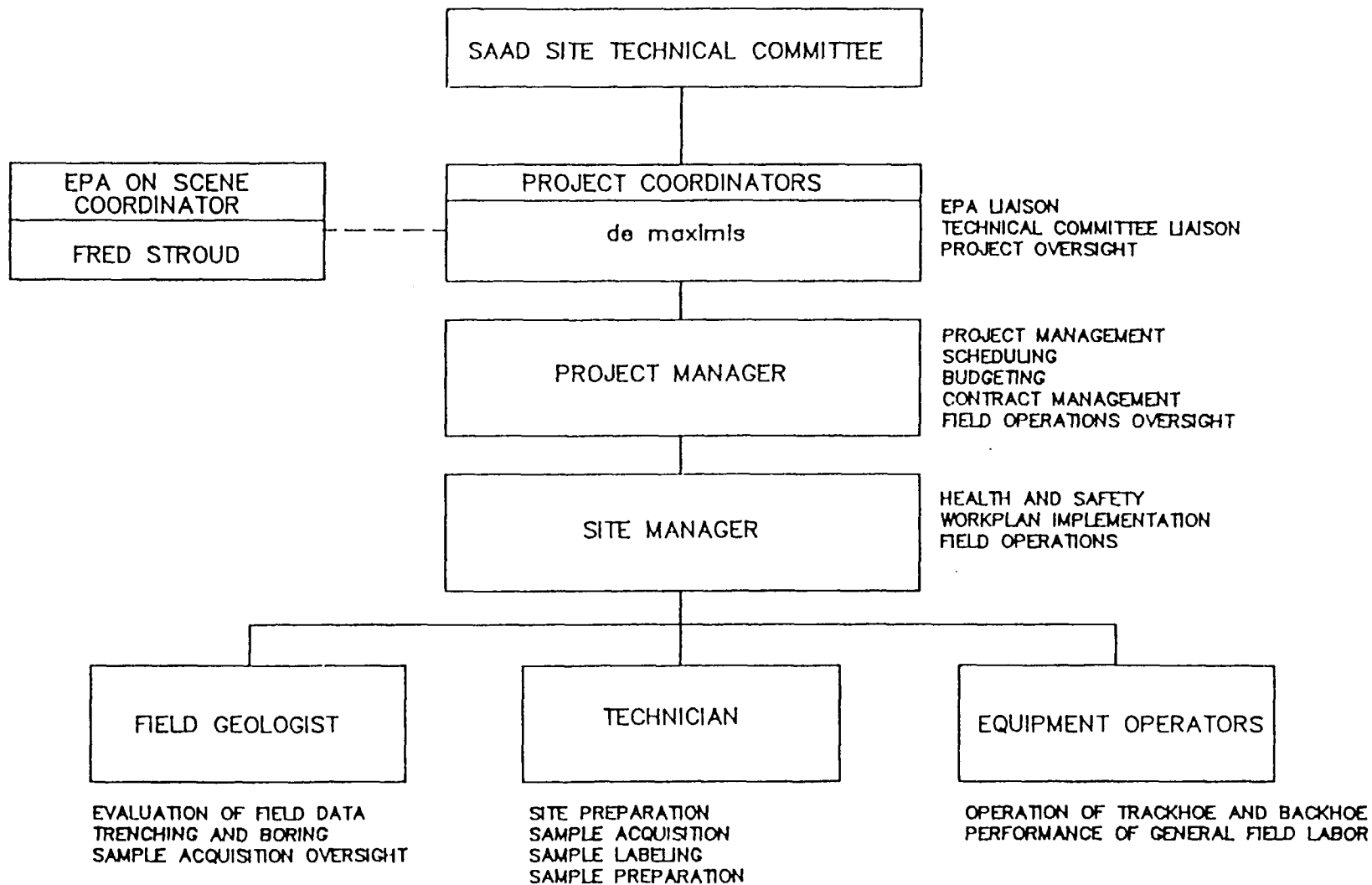


FIGURE 1.2
PROJECT TEAM FOR THE REMOVAL ACTION/FIELD INVESTIGATION
SAAD SITE

empe. INC.

all technical project activities including those activities related to scheduling, budgeting, contract management as well as providing oversight for all on-site field operations.

- The Site Manager (SM) will be responsible for implementation of the Work Plan and management of on-site field operations. The Site Manager will also serve as the Safety Officer for this project and thus will be responsible for implementation of the Site Safety Plan included as Appendix I of the Work Plan.
- The Field Geologist will be responsible for directing all trenching and boring activities, evaluating all field data obtained during on-site activities, and for the oversight of all acquisition of soil samples.
- Technician(s) will be responsible for various field activities including but not limited to actual acquisition of soil samples, labeling of samples, and carrying out required decontamination activities.
- Equipment Operators(s) will be responsible for the operation of such equipment as trackhoes or auger rigs and will be responsible for general field labor as necessary.
- The Laboratory will provide sample containers and will be responsible for ensuring that samples acquired during on-site activities are received, documented and the results submitted to the Contractor in accordance with all required procedures. The Laboratory will also be responsible for all necessary QA surveillance and audit functions in accordance with US EPA Contract Laboratory Program (CLP) protocols to assure that the laboratory phase of this project is conducted in accordance with the terms and conditions of this QAPP.

3.0 QUALITY ASSURANCE (QA) OBJECTIVES FOR DATA MEASUREMENT

The quality assurance objective for data measurement is to ensure that environmental monitoring data of a known and acceptable quality are obtained. The quality assurance objectives for Site analytical data are to ensure that:

- The data generated will be scientifically valid.
- The data generated will be of sufficient quality to withstand legal scrutiny.
- The data will be gathered and/or developed in accordance with procedures appropriate for the intended use of the data.
- The data generated will be of known and acceptable completeness, representativeness, comparability, quantitation limits, precision and accuracy.

Data from laboratory analysis of soil samples taken from the Site will be used to characterize conditions at the Site and to aid in selecting options for any subsequent remediation of the Site.

Analyses of samples taken during the on-site activities described in this Work Plan will be analyzed for the compounds included on the US EPA Contract Laboratory Program Target Compound List/Target Analyte List (CLP TCL/TAL). A list of these compounds is included as Attachment A. The analytical method descriptions and method references are included as Attachment B.

All procedures detailed in the attached Specialized Assays quality assurance manual (included as Attachment C) will be adhered to by the laboratory during this project unless these are in direct conflict with CLP protocols; if this is found to be the case, CLP protocols will be followed and will take precedence over all other laboratory standard operating procedures (SOPs) and QA/QC methodology.

3.1 COMPLETENESS

Completeness is the percent of measurements made which are judged to be valid. The completeness of the data reflects that all the required samples have been taken and

the appropriate analyses have been performed so that an adequate body of data is generated to successfully complete the objectives of the project as defined in the Work Plan. The CLP requirements for data completeness along with those for precision and accuracy are included in this QAAP as Attachment D.

3.2 REPRESENTATIVENESS

Representativeness is the degree to which the sample data accurately and precisely represent an environmental condition. Representativeness is achieved by making certain that sampling locations are selected properly and a sufficient number of samples are collected. Representativeness will be addressed by describing the rationale for sampling points and analytical parameters in the sampling section (Section 2.5) of the Work Plan.

3.3 COMPARABILITY

Comparability is indicative of the confidence with which one data set can be compared with another. The Work Plan will specify that the sampling methods employed, the chain-of-custody methods through which the samples are transferred to the analytical laboratory and the analytical methodology employed by the laboratory be performed in a uniform manner.

3.4 QUANTITATION LIMITS

The quantitation limit for a given parameter is defined by the EPA Contract Laboratory Program (CLP) protocol. The contract analytical laboratory performing analyses on samples taken during on-site activities will adhere to the protocols set forth in the most recent CLP protocol available. A list of the TCL/TAL compounds and their respective method detection limits is included as Attachment E.

3.5 PRECISION

Precision measures the reproducibility of measurements under a given set of conditions. Precision will be expressed in the following statistical terms: standard

deviation, relative standard deviation, and range or relative range. The contract laboratory objective for precision will be to meet or exceed the level of precision demonstrated for similar samples and will be within the established EPA control limits for the method(s) employed.

3.6 ACCURACY

Accuracy is a measure of the error or bias in a sample program. Some examples of bias include contamination or errors made during sample collection, preservation, handling, and analysis. The level of accuracy shall be assessed by the collection of field/trip blanks and in the laboratory through the use of known and unknown QC samples and matrix spikes. Accuracy shall be measured by the percent bias or percent recovery. The laboratory objective for accuracy shall be to meet or exceed the accuracy demonstrated for the analytical methods on similar samples and will be within the established EPA control limits.

4.0 SAMPLING PROCEDURES

This Work Plan includes provisions for the acquisition of a variety of media. While most sampling conducted during this project will be directly related to the characterization of on-site soils, some sampling of other media will be necessary in support of waste characterization and disposal efforts.

A number of sample types may be collected including liquids, solids, sludges or vapors from various drums, containers, boreholes, or trenches. The acquisition of surface soil, sediment or rock samples may also be necessary. Section 2.5 will provide discussions of the sample collection techniques applicable to the various environmental media. Generally, sampling procedures will be based upon acceptable EPA practices.

4.1 DRUM SAMPLING

Closed drums, barrels or other containers containing liquid materials requiring

sampling will be sampled through the use of a drum thief, coliwassa or similar device; drums containing solid materials will be sampled with a sample auger or similar instrument.

4.2 TRENCHING

Trenching will be performed to carefully remove sections of soil during subsurface soil studies. This method of sampling entails the excavation of a trench into the subsurface of the soil and the acquisition of samples from either soil in the bucket of the trenching equipment (although not directly in contact with the equipment surface) or from the trench walls through the use of a soil punch, a trowel or a similar device.

4.3 SURFACE SOIL OR SEDIMENT

The acquisition of necessary surface soil or sediment samples will be accomplished through the use of hand augers, scoops or similar devices.

4.4 SUBSURFACE SOIL OR ROCK

Samples to be examined only for lithologic description may be collected using either a split-barrel or thin-walled drive sampler or by collecting cuttings returned to the surface by the flights of a hollow-stem auger.

Soil samples designated for chemical or physical (permeability, Atterberg Limits) analysis may be collected by using a variety of devices such as split spoons, split-barrel drive samplers and/or continuous coring devices.

4.5 BLANKS AND DUPLICATES/SPLITS

The following blank and duplicate and/or split samples will be collected and analyzed as specified in the general field operations section (Section 2) of the Work Plan.

4.5.1 Trip Blanks

The purpose of a trip blank is to determine whether contaminants may have been introduced during sample shipment. Trip blanks are analyzed for purgeable

compounds only and are consist of sample bottles filled in the laboratory with organic-free water and sent to the sampling locations along with sampling kits. The unopened trip blanks are then returned to the laboratory, along with the samples acquired during the sampling event, and analyzed.

4.5.2 Field Blanks

The purpose of field blanks is to indicate whether possible contamination of samples has occurred through the sampling equipment. There are two basic types of field blank samples: ambient-condition blanks and equipment blanks.

Ambient-condition blanks are collected by carrying empty sample bottles into the field and filling these with an approved water on-site. These samples are then preserved and handled in the same manner as the environmental samples. Analysis of these samples is performed to determine whether airborne contamination was introduced during sample collection.

Equipment blanks consist of samples collected from final rinsate water generated during decontamination of field sampling equipment. These samples are then preserved, handled and analyzed to determine whether contamination may have been introduced due to the improper decontamination of sampling equipment.

4.5.3 Duplicates

Sample duplicates are collected to assure the precision of the sampling and analytical processes. Each duplicate will be labeled with a sample number but not identified as a duplicate. Duplicate samples are generally collected by mixing a quantity of sample of water or soil (to be analyzed for non-volatile parameters) and collecting a sample and a duplicate from the mix. Care must be taken to document duplicate sample numbers in the field notes. Analysis of duplicate samples is then performed at the analytical laboratory and the results reviewed to detect discrepancies in the resultant data.

4.5.4 Split Samples

The purpose for and process of collecting split samples are essentially the same as those of duplicate samples as discussed above. The difference between the two being that split samples are transported to separate analytical laboratories for analysis as opposed to one lab in the case duplicate samples.

5.0 SAMPLE CUSTODY PROCEDURES

In order for sample analytical data to be defensible, the integrity and identity of samples must be well maintained and documented. The history of each sample and handling of each sample must be documented through all transfers of custody until it is received at the analytical laboratory. Internal laboratory records then document the custody of the sample through its final disposition. A sample is considered to be in someone's custody if:

- It is in one's actual physical possession;
- It is in one's view, after being in one's physical possession;
- It is in one's physical possession and then locked or otherwise sealed so that tampering would be evident; or
- It is kept in a secure area, restricted to authorized personnel only.

To summarize, the possession of samples will be traceable from the time they are obtained until they are introduced as evidence in support of a decision or as evidence in legal proceedings.

5.1 SAMPLE IDENTIFICATION

All samples will be identified by a sample label affixed to each sample or container.

The sample label will include the following information:

- Sample identification
- Date and time of collection
- Initials of sample collector

- Sample site
- Sample type

All sample labels will be completed using black, waterproof ink. Each sample will be designated with a unique alphanumeric code which will identify the sample. After collection, each sample will be maintained under chain-of-custody procedures until it is in the custody of the laboratory. Additionally a tamperproof seal will be affixed to each sample container upon the placement of sample material in the container.

If a sample is to be split, it will be apportioned into similar sample containers and the labels for each of these containers will contain identical information except that one of the labels will be marked "Split". Similarly, labels will be marked for "Blank" or "Duplicate" samples.

If an error is made during the recording of information, the error may be corrected by lining through the error, entering the correct information, and initialing and dating the correction.

5.2 FIELD CHAIN-OF-CUSTODY PROCEDURES

The Site Manager is responsible for the care and custody of the samples collected until they are properly accepted by the analytical laboratory. A chain-of-custody form will be completed for each set of samples transported to the laboratory. This form will include the following information (also included on the individual sample labels) regarding each sample shipped to the laboratory:

- Sample identification
- Sample type
- Date and time of collection
- Initials of sample collector
- Sample site
- Signatures of persons involved in chain of possession

- Inclusive dates and times of possession
- Analyses requested
- Date and time of receipt by the analytical laboratory

Any time possession of a sample changes, the date, time and name of the person taking possession of the sample must be included on the chain-of-custody form. After the samples are accepted by the laboratory, the completed chain-of-custody form will be returned to the Project Manager for inclusion in the project file. Additionally, information regarding the acquisition of all samples along with a record of all photographs taken as part of the sampling documentation procedure will be recorded in a bound field logbook kept by the Site Manager.

5.3 LABORATORY CHAIN OF CUSTODY PROCEDURES

All contract laboratory chain-of-custody procedures are described in the attached quality assurance manual provided by Specialized Assays and will be followed unless any of the provisions of the standard procedures are in direct conflict with the CLP protocols; in which case the CLP protocols will take precedence.

5.4 FINAL EVIDENCE FILES

All documents generated by the laboratory relating to samples such as tags, data sheets, chain-of-custody and laboratory records shall be retained as part of the permanent documentation. All laboratory analytical data reports shall be directed to the Project Manager for inclusion in the project file along with the chain-of-custody information and other related project documents.

6.0 FIELD ANALYTICAL/DETECTION EQUIPMENT

The Site Manager (SM) will be responsible for assuring that all field instruments are calibrated as indicated in this section. The SM will also be responsible for maintaining a master calibration file for each measuring and testing device which includes, at a minimum,

the following information:

- Name of device
- Device serial and/or identification number
- Frequency of calibration
- Date of last calibration
- Name of party performing last calibration
- Due date for next calibration

Following are the field instruments that will be used at the site along with instructions for frequency and methods of calibration.

6.1 H-NU PHOTOIONIZATION DETECTOR (PID)

The H-Nu organic vapor detector will be maintained and field calibrated daily using an analyzed gas mixture provided in a pressurized container, in accordance with the manufacturer's instructions. The battery on this instrument will be checked at 2-hour intervals during periods of continuous use.

6.2 COMBUSTIBLE GAS/OXYGEN METER

The combustible gas/oxygen meter used at the site will be maintained and calibrated daily or prior to each use in accordance with manufacturer's instructions. The combustible gas indicator function will be calibrated through the use of a cylinder of compressed gas of known concentration and lower explosive limit (LEL) value. The oxygen meter function will be calibrated in a normal atmosphere to 21%. The battery powering this device will be checked at 2-hour intervals during periods of continuous use.

7.0 ANALYTICAL LABORATORY FUNCTIONS

All laboratory functions including but not limited to calibration, internal quality control, systems audits, preventative maintenance of lab instrumentation, data assessment procedures, and corrective action are addressed in detail in the attached Specialized Assays

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quality assurance manual (Attachment C).

ATTACHMENT A

CONTRACT LABORATORY PROGRAM
TARGET COMPOUND LIST/TARGET ANALYTE LIST

Volatile Organic Compounds

Chloromethane	Trichloroethane
Bromomethane	Dibromochloromethane
Vinyl chloride	1,1,2-Trichloroethane
Chloroethane	Benzene
Methylene chloride	cis-1,3-Dichloropropene
Acetone	2-Chloroethyl vinyl ether
Carbon disulfide	Bromoform
1,1-Dichloroethene	2-Hexanone
1,1-Dichloroethane	4-Methyl-2-pentanone
trans-1,2-Dichloroethene	Tetrachloroethene
Chloroform	Toluene
1,2-Dichloroethane	Chlorobenzene
2-Butanone	Ethylbenzene
1,1,1-Trichloroethane	Styrene
Carbon tetrachloride	Xylenes (total)
Vinyl acetate	
Bromodichloroethane	
1,1,2,2-Tetrachloroethane	
1,2-Dichloropropane	
trans-1,3-Dichloropropene	

Base/Neutral and Acid Extractables

Phenol	Dimethylphthalate
bis(2-Chloroethyl) ether	Acenaphthylene
2-Chlorophenol	3-nitroaniline
1,3-Dichlorobenzene	Acenaphthene
1,4-Dichlorobenzene	2,4-Dinitrophenol
Benzyl alcohol	4-Nitrophenol
1,2-Dichlorobenzene	Dibenzofuran
2-Methylphenol	2,4-Dinitrotoluene
bis(2-Chloroisopropyl) ether	2,6-Dinitrotoluene
4-Methylphenol	Diethylphthalate
n-Nitroso-dipropylamine	4-Chlorophenyl phenyl ether
Hexachloroethane	Fluorene
Nitrobenzene	4-Nitroaniline
Isophorone	4,6-Dinitro-2-methylphenol
2-Nitrophenol	n-Nitroso-diphenylamine
2,4-Dimethylphenol	4-Bromophenyl phenyl ether
Benzoic Acid	Hexachlorobenzene
bis(2-Chloroethoxy) methane	Pentachlorophenol
2,4-Dichlorophenol	Phenanthrene
1,2,4-Trichlorobenzene	Anthracene

TARGET COMPOUND LIST/TARGET ANALYTE LIST, continued

Base/Neutral and Acid Extractables, (continued)

Naphthalene	Di-n-butylphthalate
4-Chloroaniline	Fluoranthene
Hexachlorobutadiene	Pyrene
4-Chloro-3-methylphenol	Butyl benzyl phthalate
2-Methylnaphthalene	3,3-Dichlorobenzidine
Hexachlorocyclopentadiene	Benzo(a)anthracene
2,4,6-Trichlorophenol	bis(2-Ethylhexyl)phthalate
2,4,5-Trichlorophenol	Chrysene
2-Chloronaphthalene	Di-n-octyl phthalate
2-Nitroaniline	Benzo(b)fluoranthene
	Benzo(k)fluoranthene
	Benzo(a)pyrene
	Indeno(1,2,3-cd)pyrene
	Dibenzo(a,h) anthracene
	Benzo(g,h,i)perylene

Pesticides/PCBs

alpha-BHC	Endrin ketone
beta-BHC	Methodychlor
delta-BHC	Chlordne
gamma-BHC (Lindane)	Toxaphene
	Heptachlor
Aldrin	Aroclor-1016
Heptachlor epoxide	Aroclor-1221
Endosulfan I	Aroclor-1232
Dieldrin	Aroclor-1242
4,4-DDE	Aroclor-1248
	Aroclor-1254
	Aroclor-1260
Endrin	
Endosulfan II	
4,4-DDD	
Endosulfan Sulfate	
4,4-DDT	

Metals and Cyanide

Aluminum	Magnesium
Antimony	Manganese
Arsenic	Mercury
Barium	Nickel
Beryllium	Potassium
Cadmium	Selenium
Calcium	Silver
Chromium	Sodium
Cobalt	Thallium
Copper	Vanadium
Iron	Zinc
Lead	Cyanide

ATTACHMENT B

ANALYTICAL METHODS

Parameters	Method Reference	Method Description
<u>Sample Preparation</u>		
Separatory Funnel	CLP-SOW	Preparation of samples for determination of nonvolatile extractable organic compounds.
Liquid-Liquid Extraction	CLP-SOW	
Sonication	CLP-SOW	
Purge and Trap	CLP-SOW	Removal and isolation of volatile organic compounds from water, soils, sediments or other media.
<u>Organic Compounds</u>		
Base/Neutral/Acid Extractible Compounds	CLP-SV	GC/MS analysis of semi-volatile and non-volatile compounds.
Volatile Compounds	CLP-VOA	GC/MS analysis of volatile compounds.
Pesticides and PCBs	CLP-PEST	GC analysis of pesticides and PCBs in water, soils and sediments.
<u>Inorganics</u>		
ICP Ag, Al, Sb, Ba, Ce, Ca, Cr, Co, Cu, Fe, Mg, Mn, Ni, K, Na, V, Zn	200.7 CLP-M	Inductively Coupled Plasma determination.
<u>Furnace AA</u>		
Arsenic	206.2 CLP-M	Atomic absorption furnace techniques.
Cadmium	213.2 CLP-M	Atomic absorption furnace techniques.
Lead	239.2 CLP-M	Atomic absorption furnace techniques.
Selenium	270.2 CLP-M	Atomic absorption furnace techniques.
Thallium	279.2 CLP-M	Atomic absorption furnace techniques.
Cold-Vapor AA		
Mercury (in water)	245.1 CLP-M	Cold vapor generation and atomic adsorption analysis.
Mercury	245.5 CLP-M	Cold vapor generation and atomic adsorption analysis.
Other 335.2 Cyanide	CLP-M	Distillation and trapping of HCN gas followed by colorimetric measurement.

ATTACHMENT C

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SPECIALIZED ASSAYS
ENVIRONMENTAL TESTING SERVICES

QUALITY ASSURANCE MANUAL

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1.0 INTRODUCTION

1.1 PURPOSE

Laboratory data may be used for many purposes from the control of industrial processes to the monitoring of the environment. Whatever the application of the data generated, it must be of a known high quality.

It is the purpose of the quality assurance program defined in this manual to provide the necessary assistance to the analytical chemist such that the quality of the data may be readily ascertained and controlled. This document will describe appropriate systems for the control of the entire analytical process from sample receiving to data reporting. This manual will be updated regularly under the direction of the laboratory manager and QA officer. A copy of this manual will be made available to all lab personnel.

The terms "Quality Assurance" and "Quality Control" will be defined for the purpose of this manual as follows:

QUALITY ASSURANCE : Those procedures, policies, objectives, and principles which, when properly integrated into the total laboratory system, are intended to produce data of known quality.

QUALITY CONTROL : Functional, specific actions taken by the analyst to verify processes within the laboratory.

1.2 RESPONSIBILITIES AND GUIDELINES FOR PERSONNEL

1. The final responsibility for the quality of data produced by the laboratory resides with the laboratory director. His decision on the reportability of data is final.
2. The QA officer will be responsible for the daily monitoring of the QA program. He will provide corrective action as needed. He will report directly to the lab manager.
3. All personnel will strive to meet the requirements of the QA program as it relates to their area, and they will maintain appropriate records to confirm that all quality control procedures have been followed.
4. All personnel will have access to this document and are encouraged to discuss the contents with management at any time; however, no changes may be made without the approval of the lab QA officer or lab manager.
5. Only approved methodology may be used in the laboratory. Generally, EPA methods are

chosen when available. No substitutions or modifications are to be made without approval.

6. All personnel will undergo a period of training in quality control procedures. This training will be documented and filed in the personnel file.

2.0 ORGANIZATION

2.1 PURPOSE

To function smoothly, the members of the staff must clearly understand and meet their responsibilities as they relate to quality control. Those responsibilities are delineated in this section.

2.2 SPECIFIC RESPONSIBILITIES

2.2.1 Laboratory Manager and Technical Director

This individual will be responsible for the following:

1. Design and implementation of the QA program within the laboratory.
2. Provide the technical direction of the laboratory as related to systems and procedures. Some authority may be delegated to appropriate individuals depending upon the situation, but the final responsibility lies with the director.
3. Work with the QA officer to monitor and modify if necessary the components of the QA program.
4. Approve all changes in procedures or quality control.
5. Approve all data before reporting to the client.
6. Design and maintain a laboratory organizational chart.
7. Supervision of proficiency testing programs offered by regulatory agencies.

2.2.2 Quality Assurance Officer

This individual will be responsible for the following:

1. Daily monitoring of quality control procedures.

2. Maintenance of appropriate QC charts and documents.
3. Inform the area supervisor of QC errors and work with the supervisor to develop a plan of corrective action. All of these actions must be documented.
4. Initiation of an in-house proficiency evaluation program involving blind samples.
5. Keep the lab manager and supervisors apprised of the general state of the quality assurance program.

2.2.3 Sample Officer

This individual will be responsible for the following.

1. Supervision of the log-in of all samples into the computer system.
2. Monitoring the daily worksheets to assure that samples are analyzed within appropriate holding times.
3. Report to the laboratory manager any anomalies in sample handling, e.g., samples not analyzed within holding times.
4. Insertion into the system of appropriate quality control samples, i.e., blanks, spikes, etc...
5. Supervise the storage of samples from the time they are received in the laboratory until they are disposed.
6. Maintain all chain of custody documents.
7. Serve as the focal point for client inquiries.
8. Supervise the distribution of appropriate sample containers to clients.

2.2.4 Supervisors

These individuals will be responsible for the following:

1. Evaluation of instrument, software, and personnel performance in their section. This will involve making recommendations to the laboratory manager on matters of selection of equipment and personnel. Also included will be the yearly evaluation of personnel performance.

2. Maintenance of instrumentation such that the equipment is in proper condition to allow the data produced to be of high quality.
3. Supervise the analysis of all samples including QC samples. These results should be evaluated against appropriate control limits and decisions made as to the reportability of data.
4. Maintenance of QC records in an orderly manner such that the lab manager, QA Officer, regulatory agents, and clients, can readily review the data.
5. Report immediately to the lab manager any problems that will affect the quality of data. This includes holding time problems as well as any analytical problems.
6. The supervisor will be directly responsible for the daily operation of their area. This includes scheduling of personnel and communication of necessary information to all other areas.

2.2.5 Analytical Chemists

The laboratory analyst are responsible for the following:

1. The performance of analytical procedures according to approved protocol. This will include the analysis of appropriate QC material and the recording of the data obtained from those analyses.
2. The analyst will report any out of control situations directly to the area supervisor before reporting the data.
3. The analyst will familiarize himself with the manufacturers recommended maintenance schedule for instruments in his area and will perform and document these maintenance steps.

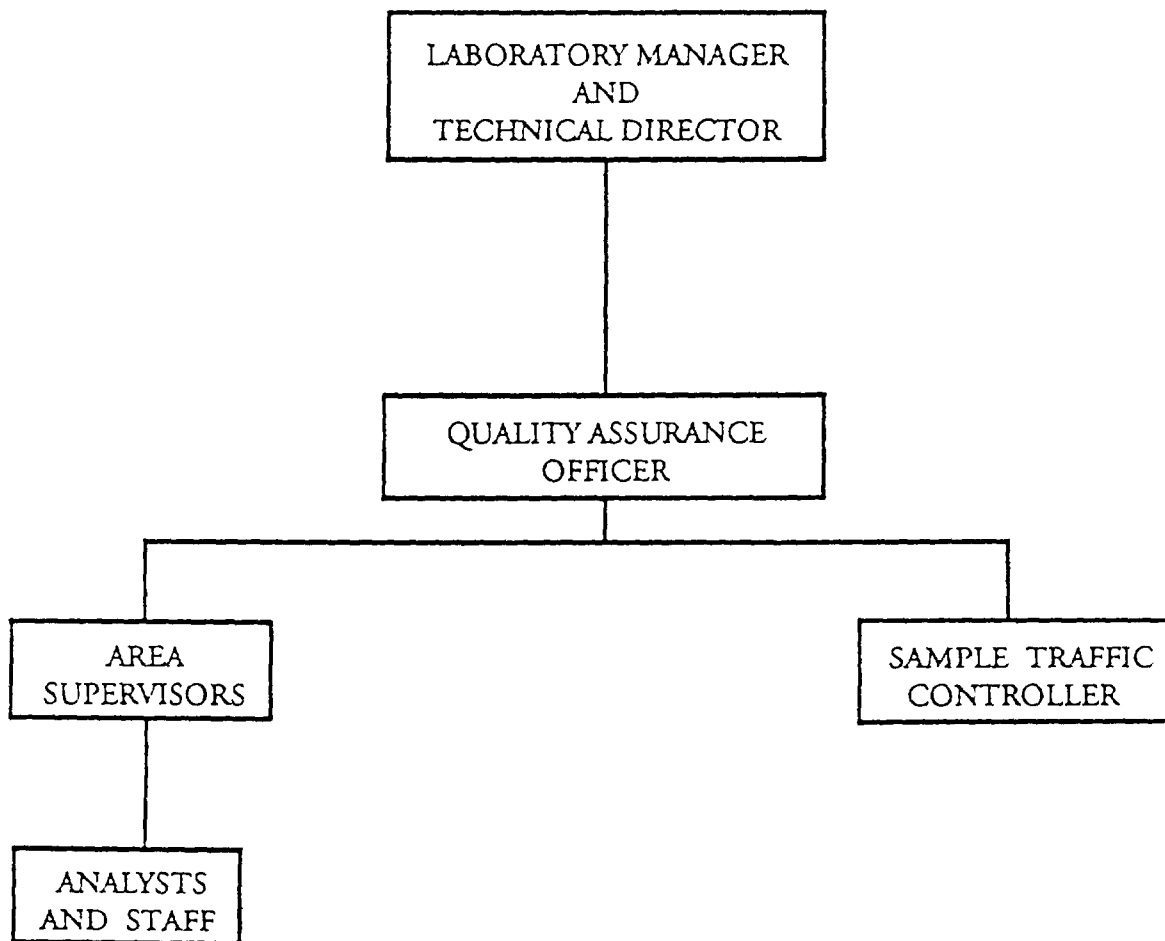
2.2.6 Education / Training of Personnel

Qualifications of laboratory personnel will be as follows:

1. Minimum education requirements will be a bachelors of science degree from an accredited 4 year college or university.
2. Experience will be a minium of 6 months to 2 years relative to the specific performance requirements.

3. All analyst will be trained internally in QA procedures and protocols.
4. Each analyst must demonstrate proficiency in the respective test procedures and be approved by the area supervisor and QA Director prior to reporting analytical data.
5. Documentation of all education, training and previous experience must be retained in personnel files.

FIGURE 2-1

LABORATORY ORGANIZATIONAL CHART
ENVIRONMENTAL DIVISION

3. Volumetric glassware should be "Class A."
4. Glassware used in the digestion of samples for trace metal analysis should be cleaned before use with DI water and a nitric acid rinse. This glassware should be used one time and discarded.

Organic analysis:

1. Solvents used in the preparation or extraction of organic analytes should be of "Pesticide grade" quality.
2. Standards should be made from analytical grade starting materials or purchased from a vendor supplying standards referenced to the NBS.

Water:

1. Water will be considered to be "laboratory grade" if it has been passed through a charcoal filter to remove organics and has a resistance greater than 10 megohms after passing through an ion exchange resin.
2. The quality of the water will be determined each day by checking the resistance. Additionally, the water will be cultured weekly to detect bacterial growth.
3. Any detection of contaminants in the water will be reported to the QA officer or to the laboratory director.

Glassware:

1. Volumetric glassware should be "Class A."
2. Pyrex glassware should be used in all instances except in disposable glassware.
3. All test tubes will be disposable glass.
4. Plastics may be used to store inorganic standards and reagents but should not be used with organic solvents.

Storage of reagents:

1. Light sensitive reagents should be stored in brown glass bottles.
2. All organic reagents should be stored in a refrigerator or freezer.
3. Organic reference materials will be stored in a freezer.
4. Fresh solutions of working standards will be prepared from a stock solution and will be compared to the old working standard before placing it into service.

3.3 CLEANING OF GLASSWARE

Methods of cleaning glassware are selected according to the substances that are to be removed and the analysis that is to be performed. Water soluble substances can be removed with tap water followed with at least three rinses with laboratory grade water. In some instances detergent may be required. This should be removed by thoroughly rinsing with tap water followed by repeated rinsing with laboratory grade water. General guidelines are:

Organic glassware:

1. Rinse the glassware one time with acetone and one time with methylene chloride.
2. Wash the glassware one time with hot soapy water.
3. Rinse 5x with tap water and 3x with laboratory grade water.
4. Dry the outside of the glassware with a towel.
5. Rinse the inside of the glassware with acetone 2x and methylene chloride 2x.
6. If visual inspection indicates remaining contamination, rinse the glassware in concentrated sulfuric acid and then repeat steps 2-5. If the contamination remains, discard the piece of glassware.

Inorganic glassware:

1. Wash the glassware in hot soapy water making sure all surfaces are covered.
2. Rinse at least 5x with tap water and 3x with laboratory grade water.

3. For trace metal analysis, rinse a final time with nitric acid followed by triplicate washings with laboratory grade water.
4. Air dry the glassware and store protected from contamination.
5. All glassware used for GC / MS analyses will be sealed and stored in an enclosed area.

Sample collection glassware:

1. Glassware for the collection of volatiles should be baked at 150 degrees C for two hours and capped while hot.
2. Glassware for organic determinations should be rinsed with hexane and baked for two hours at 150 degrees C and capped while hot.
3. Glassware for trace metal collection should be washed as described above under trace metal glassware.

4.0 STANDARD PRACTICES

4.1 INTRODUCTION

The actual analysis of a sample to obtain laboratory data is only a small part of the overall process that generates good quality data. Many steps are taken before and after analysis to control the quality of the data generated. All of these steps, when taken as a whole, represent the quality assurance system of the laboratory.

The quality assurance program should both control the process before data is generated, and provide a system to verify that the data is correct once it has been generated. A broad perspective is required to see the entire program as it functions. That general review is the purpose of this section.

4.2 SAMPLE ACCESSIONING

Before any analysis can be initiated, the following steps must be taken:

1. The sample must be received by the accessioning department and checked to see that it is appropriate for the analysis requested.
2. The external chain of custody is completed and filed.
3. The internal chain of custody is initiated.
4. A laboratory number is assigned to the sample and a project number is assigned to the group of samples on the chain of custody sheet.
5. Worksheets are produced to define the testing required.
6. Samples are placed in the proper storage facility along with the internal chain of custody sheet.
7. Samples are entered into the laboratory information system.
8. Key personnel are notified if a sample requires special attention or handling.

4.3 PRE-ANALYSIS PREPARATION IN THE ANALYTICAL GROUPS

Before any testing can begin on the sample, there are specific actions that must be taken that will have a direct influence on the quality of the data generated.

4.3.1 CONTROL OF REAGENTS AND STANDARDS

1. Proper grades of reagents, solvents, water, etc... are verified for the procedure to be undertaken.
2. Proper analytical glassware is gathered and cleaned.
3. Standards and reagents are verified that they have not passed their proper expiration date.

4.3.2 INSTRUMENT MAINTENANCE

1. Instruments are serviced based upon the manufacturers recommendations.
2. Spare parts are gathered and inventoried.
3. The instrument history, i.e., service, maintenance, repair, tuning, etc... are logged for easy retrieval.

4.3.3 INSTRUMENT CALIBRATION

1. The instrument should be calibrated against standard calibration materials for such parameters as wavelength, standard absorption, mass, time, gas flow, temperature, etc... This is not the calibration that is assay specific.
2. The instrument should be calibrated to determine the response to the compounds being assayed. The frequency of this calibration will vary with the specific assay.

4.3.4 ANALYTICAL PROCEDURES

The actual assay of samples is a group of steps that can be described as follows:

1. A review of the sample preservation and holding times indicates that sample integrity has been maintained.
2. The sample is analyzed by an approved method.

3. Associated quality control samples are analyzed.
4. All associated analytical data is filed for easy retrieval.
5. Complete the appropriate chain of custody document and return the sample to storage.

4.4 PROCESSING OF QUALITY CONTROL DATA

There are several distinct steps involved in the proper utilization of quality control samples. These steps are outlined as follows:

1. Perform the appropriate analysis on the QC samples. This analysis should parallel the analysis of the associated unknown samples as closely as possible.
2. Calculate the final results from the data obtained.
3. Compare the results to established ranges.
4. File the data with the results of the unknown samples for further reference.

Once the data has been properly evaluated, it should be used to update the control charts. All data should be plotted whether it is in or out of the control limits. All data is used to calculate new means and standard deviations. If an out of limit control is plotted, the value should have an explanation beside it to explain the corrective action taken.

4.5 CORRECTIVE ACTION

Quality control data that does not meet acceptable standards always prevents the analyst from reporting the data. This does not mean however, that the data is totally unacceptable. If it is possible to reanalyze the sample, this is the appropriate step. If it is not possible to reanalyze, e.g., insufficient sample and recollection is not possible, the final decision as to the reportability of the data lies with the laboratory manager or his appointed representative. In such cases the decision may be made to report the data with an attached explanation.

4.6 REPORTING

Data used to derive final analytical results should be filed in such manner that it is easily retrievable. Calculations should be reported on the proper worksheet. Data is entered into the laboratory computer system for final reporting. Once reports are printed they are reviewed by the area supervisor and finally by the the laboratory manager before they are distributed to the client.

All data which is specific to a particular sample should be filed with that sample. If a sample is analyzed with a separate group, it is acceptable to file the sample with specific pointers to that data group. No data should ever be destroyed.

Data that is generated that does not relate to any specific project, e.g., instrument maintenance records, temperatures, etc... should be filed for easy retrieval. These records demonstrate the laboratory's adherence to the QA program.

5.0 SAMPLE PROCESSING

5.1 PURPOSE

It must be assumed that the data obtained from a sample is representative of the larger source from which it was collected. It is the responsibility of the sample collector and the laboratory performing the analysis to insure that the integrity and reliability of the sample is intact from the point of sampling until the data has been reported and accepted by the client. This section deals with proper protocol to be followed to insure that integrity.

5.2 CHAIN OF CUSTODY

A document is required to certify that the sample has not been altered or contaminated. This document will detail the path the sample travels from the moment of collection to final disposal. This will allow possible determination of the quality and integrity of the sample and will allow tracking of the person or persons involved in the collection, transport, analysis, and disposal of the sample.

A sample is said to be in the possession of an individual if:

1. It is in the actual physical possession of that person.
2. It is in the view of that person after that person has had it in his physical possession.
3. It is locked in such a way that no one can tamper with it after having it in his possession.
4. It is in a secured, restricted area.

It is recommended that all samples received by the laboratory have an intact chain of custody associated with them. It is required that all samples being analyzed for reporting to a regulatory agency have a chain of custody form. If a sample is received without such a form the client should be contracted for instructions. Figure 5-1 is a copy of the current chain of custody form in use by the laboratory. The form should be completed as follows:

1. Each client should use only the pre-printed request/ chain of custody forms.
2. The client will be responsible for the proper completion of the sample description and analysis requested components of the form. Date and time collected should also be completed.
3. The person collecting the samples should insure that each sample is uniquely labeled and they correspond to the chain of custody sheets.
4. The person collecting the samples begins the chain of custody process by signing the block indicating that he was responsible for sample collection.
5. The sampler will sign the first "relinquished by" block when he transfers custody of the samples for transport to the laboratory.
6. The person transporting the samples will sign the "received block" and subsequently the "relinquished block" as he transfers control.
7. This process continues until the samples reaches the laboratory accessioning section where the appointed individual will sign the "received by laboratory" section.
8. The accessioning department will compare the samples to the chain of custody and initiate the in-house chain of custody forms. If there are discrepancies in the samples or in the chain of custody the client will be notified immediately. Any notes concerning the disposition of the samples will be made on the chain of custody and initialed by the accessioning individual.
9. If samples are transported by commercial carrier, the samples and chain of custody should be sealed in a shipping container with the chain of custody forms protected from water by using plastic bags.
10. A copy of the chain of custody should be given to the client and the original should be filed with the project data.

5.3 SAMPLING

Our laboratory does not have a sample collection team, therefore; it is the responsibility of the client to see that the samples are properly collected, preserved, and transported to the laboratory.

Bottles with assay specific preservatives are available upon request. Labels are color coded according to the preservatives contained in the bottle.

The client should fill out the label information completely, e.g., indicating whether or not the sample has been field filtered. The information on the label should match the information on the chain of custody sheet.

It should be noted that many analyses require that the samples be kept cool during transport and storage. Additionally, the holding times for the requested assays begin at the sampling time.

5.4 ACCESSIONING

The accessioning process is critical to the proper analysis of the samples. This process should involve the following steps:

1. The samples should be examined to insure that all are intact and have not been damaged or compromised by the transport to the laboratory. If there are problems, the chain of custody should be used to note the situation, and if it affects the analysis requested, the client should be notified immediately.
2. The samples should be thoroughly checked against the chain of custody to see that there are no discrepancies. Any observed problems should be noted on the request and the client notified.
3. Attention should be paid to the sampling times. If there is a problem with the holding times for the analysis, the client should be notified.
4. The chain of custody should be signed by the accessioning representative.
5. A laboratory sample number is assigned to each sample set (each bottle from a site will have the same number no matter how it is preserved) and a project number will be assigned to the group of samples received.
6. The samples are logged into the accessioning log book with the following information:
 - a. Laboratory sample number
 - b. Sample identification
 - c. Client
 - d. Date collected
 - e. Date received

- f. Person collecting the samples
 - g. Type and amount of samples received
 - h. Condition of the samples received
 - i. Billing control [project] number
 - j. Date disposed
7. The proper in-house tracking sheets and worksheets should be completed and kept with the samples.
8. The samples are then transferred to the proper storage facility.

5.5 SAMPLE STORAGE

There are two primary concerns associated with sample storage: maintaining the proper storage temperature and extracting or assaying the samples within the allowed holding times. Table 5-2 indicates the proper storage temperature and holding times for various assays performed by this laboratory.

5.6 ANALYSIS

If there is a question concerning the analysis requested, the laboratory manager or his representative should be contacted. This will generally involve a consultation with the requesting client.

It will be the responsibility of the area supervisors to see that all analyses are performed within the proper holding times.

5.7 SAMPLE DISPOSAL

The chain of custody is complete when the samples have been disposed. There are several ways in which the sample may be destroyed:

- 1. The entire sample may be used in the analysis, e.g., oil and grease analysis.
- 2. The remaining sample may be returned to the client.
- 3. The sample may be stored for up to two months before finally being discarded. There should be attention paid to the nature of the sample before discarding. Samples with very high levels of pollutants, e.g., PCB's should be held for pick-up by a hazardous waste company.


SAMPLE AND PRESERVATION REQUIREMENTS

<u>PARAMETER</u>	<u>CONTAINER</u>	<u>VOLUME [ML]</u>	<u>PRESERVATION</u>	<u>HOLDING TIME</u>
Acidity	P, G	50	cool	14 d
Alkalinity	P, G	50	cool	14 d
Ammonia Nitrogen	P, G	100	cool, pH <2 [S]	28 d
BOD	P, G	1000	cool	48 hr
COD	P, G	75	cool, pH <2 [S]	28 d
Chloride	P, G	50	cool	28 d
Chlorine, total	P, G	200	none	analyze immediately
Color	P, G	50	cool	48 hr
Cyanide	P, G	1000	cool, pH >12 [NaOH] 0.6 g ascorbic acid if free chlorine is present	14 d
Fluoride	P	300	none	28 d
Kjeldahl Nitrogen	P, G	500	cool, pH <2 [S]	28 d
Metals	P, G	200	pH <2 [N]	6 mo
Mercury	P, G	100	pH <2 [N]	
Chromium IV	P, G	100	cool	24 hr
Nitrate	P, G	100	cool	48 hr
Nitrite	P, G	100	cool	48 hr
Oil and Grease	G	1000	cool, pH <2 [S]	28 d
Organic Carbon	P, G	50	cool, pH <2 [S]	28 d
Petroleum Hydrocarbon	G	1000	cool, pH <2 [S]	28 d
Phenols	G	500	cool, pH <2 [S]	28 d
Phosphorus	P, G	50	cool, pH <2 [S]	28 d
Solids, total	P, G	100	cool	7 d
Solids, suspended	P, G	100	cool	48 hr
Solids, dissolved	P, G	250	cool	7 d
Solid, settleable	P, G	1000	cool	48 hr
Solids, volatile	P, G	100	cool	7 d
Conductivity	P, G	100	cool	28 d
Sulfate	P, G	100	cool	28 d
Sulfide	P, G	500	ZnAc + NaOH pH >9	7 d
Turbidity	P, G	100	cool	48 hr
Volatile Organics	VOA vial	50	cool, HCl	14 d
Phenols	G	1000	cool, 0.008% SBS	7 d extract 40 d after ext
PCB's	G	1000	cool	7 d extract
Extractables [org]	G	1000	cool, 0.008% SBS	7 d extract 40 d after ext
Pesticides	G	1000	cool, pH 5 - 9	7 d extract 40 d after ext
Alpha/Beta, Radium	G	1000	pH <2 [N]	6 mo

TABLE 5-2 APPENDAGE

P	Plastic Container
G	Brown Glass Container with Teflon Lined Cap
SBS	Sodium Bisulfite
S	Sulfuric Acid
N	Nitric Acid

SPECIALIZED ASSAYS



Form 3035B Rev 2

BILLING CONTROL NUMBER (FOR LAB USE ONLY)						PROJECT #		P.O. #
SAMPLERS (Signature)						PROJECT NAME		
FOR LAB USE ONLY ACC #	SAMPLE DESCRIPTION	DATE	TIME	COMP.	GRAB	# OF CONT.	ANALYSES REQUESTED	
Relinquished by: (Signature)		Date/Time	Received by: (Signature)		Received for Laboratory by: (Signature)		Date/Time	
Relinquished by: (Signature)		Date/Time	Received by: (Signature)		Remarks			
Relinquished by: (Signature)		Date/Time	Received by: (Signature)					
Relinquished by: (Signature)		Date/Time	Received by: (Signature)					

6.0 PREVENTIVE MAINTENANCE

6.1 DEFINITION

Preventive maintenance is the action taken to maintain proper instrument function and performance, e.g., cleaning, lubrication, adjustment, calibration, etc. To be considered within any preventive action program are the following:

1. Awareness of the instrument manufacturers' suggested maintenance schedule. This should include parts and instruments that are susceptible to wear or deterioration with use.
2. Appropriate spare parts.
3. Frequency and assignment of preventive maintenance.

6.2 IMPLEMENTATION AND RESPONSIBILITIES

The area supervisor is responsible for the preventive maintenance of the instruments within his department. The records of such maintenance becomes part of the permanent laboratory record and are subject to review by the QA officer and laboratory manager.

Each department will identify the instruments that require specific maintenance and will design record sheets listing the maintenance required, the frequency of the maintenance, the date performed, and the initials of the person(s) involved.

These records should be updated on a monthly basis and be kept in a file, in the department, readily accessible for review.

7.0 INSTRUMENT CALIBRATION

7.1 GENERAL OVERVIEW

Instruments used in the analytical laboratory must be controlled with a formal calibration program. This program may be incorporated into the preventive maintenance program of the department. This program is necessary to demonstrate that the equipment is operating with the proper range, precision, and accuracy required by the analysis intended.

Calibrations can be performed using reference standards, filters, etc... and may be performed by laboratory personnel or by the manufacturers representative.

There are basically two types of calibration, operational and periodic. *Operational calibration* is

performed as the instrument is used in an analysis and usually involves the development of response factors or curves relating to given amounts of standards. *Periodic calibration* should be performed on a prescribed time table and involves such actions as taking temperatures of ovens, bathes, etc.

7.2 PERIODIC CALIBRATION SYSTEM

7.2.1 Procedures

Each instrument should have a written protocol for periodic calibration. Operational calibration is addressed in the methods applying to the instrument. If accepted methods are available for periodic calibration they should be followed. If an acceptable method is not available, a procedure should be developed in conjunction with the QA officer which will address the pertinent features and likely problems of the instrument. All procedures should address the following:

1. Instrument description including model and serial numbers should be included on the maintenance sheet.
2. The standards used for calibration should be noted. These should be certified by an independent source when possible.
3. Performance tolerances should be noted.
4. Performance frequency. The frequency should be at least that recommended by the manufacturer.

7.2.2 Record keeping

Records of periodic calibration may be kept with the preventive maintenance records. Data should include all of the items listed in 7.2.1 as well as the name of the person performing the analysis and the date the analysis was performed. Any actions taken in response to out of range QC data should be clearly documented.

All instrument calibration records will be maintained in a manner that allows easy access and review. These records may be kept in a folder by instrument, or in a bound notebook in the department.

7.2.3 Instrument Failures

If an instrument fails to properly calibrate, the area supervisor should be notified immediately. No analyses should be performed using the instrument until the problem is corrected and calibration falls within acceptable limits.

7.3 OPERATIONAL CALIBRATION

Operational calibration usually consists of determining the response to various concentrations of standard materials. Whenever possible these standards should be certified by an independent source.

The frequency of this calibration will be addressed in the method being used. Records of this calibration will either be filled with the sample data or will have tags within the data package pointing to the calibration in effect when the data was obtained. It is preferable that all calibration data be copied and included in appropriate data sets.

The standards, reagents, and frequency of calibrations should be determined before the method is placed into service and should be clearly described in the written method. No substitutions should be made in any reagent, standard, or calibration procedure.

7.3.1 Method Blank

The initial step in the calibration of a procedure, is the demonstration that there are no reagent interferences present. Once a solvent blank is run and evaluated, the method blank is assayed. If the cumulative blank is such that there would be interferences in accurate determinations, steps will be taken to discover the source of the contamination. If contamination cannot be eliminated, the magnitude of the contamination should be considered when calculating the final reportable result for unknowns.

A method blank is to be run with every group of samples analyzed or whenever a reagent is changed.

7.3.2 Preparation of the Standard Curve

A standard curve is analysis specific, but generally the curves are prepared as follows:

1. A standard curve is prepared using standard reference material by dissolving prescribed amounts in the solvent used in the analysis.
2. The calibration range will be determined by the instrument and will be described by the method.
3. The standard curve will determine the analytical range of the method.
4. A graphical representation of the curve is made by plotting standard concentration vs instrument response.
5. The curve should not be extrapolated to obtain values for unknowns.

7.3.3 GC/MS Calibration Procedures

This section will describe the minimum operations necessary when using the GC/MS units for analytical determinations.

1. Documentation of the mass calibration and abundance patterns for each instrument.
2. Documentation of the response factors and their stability.
3. Internal standard response factors and retention times.

7.3.3.1 Tuning of the Mass Spectrometer

In order to obtain spectra that are comparable to those obtained from other instruments, the instrument should be tuned to deliver the same spectrum from a given compound. The compound chosen to establish the abundance criteria for base/ neutral/ acid [BNA] compounds is decafluorotriphenylphosphine [DFTPP]. The compound chosen for volatile compounds is bromofluorobenzene [BFB]. The ion abundance criteria for these compounds should be achieved by proper instrument tuning before any standards or blanks are analyzed.

1. DFTPP. Each GC/ MS unit should be calibrated every shift using an injection of 50 ng of DFTPP on column. The abundance criteria for DFTPP is listed in table 7-1. The spectrum obtained should be displayed as a bar graph and in list form. This data should be filed with the data set being analyzed.
2. BFB. Each GC/ MS unit used in the analysis of volatile organic compounds should be tuned to meet the ion abundance criteria listed on table 7-2. The data from a 50 ng injection of this compound should be copied in both bar graph and list form and a copy included in the data packages of the unknowns being analyzed.

7.3.3.2 Calibration of the GC/ MS System

Subsequent to the proper tuning of the GC/ MS to BFB or DFTPP standards, the instrument must be standardized against five concentrations of analytes being determined to establish the linearity of response.

1. Volatile organics should be standardized against solutions containing 20, 50, 100, 150, and 200 ug/ l of all the compounds being analyzed. Internal standards and associated compounds are listed in table 7-3.
2. Semivolatiles should be calibrated against injections of 20, 50, 80, 120, and 160 total

nanograms of the compounds of interest. Nine compounds: benzoic acid, 2,4- dinitrophenol, 2,4,5- trichlorophenol, 2- nitroaniline, 3- nitroaniline, 4- nitroaniline, 4- nitrophenol, 4,6- dinitro-2-methylphenol, and pentachlorophenol use a four point calibration at 50, 80, 120, and 160 total nanograms. The listing of internal standards and associated compounds are found in table 7- 4.

The methods developed by the USEPA specify the concentrations for the various standards as well as the internal standards to be used with each compound. A response factor is calculated for each compound by the following equation:

$$RF = \frac{A_x}{A_{is}} \times \frac{C_{is}}{C_x}$$

RF = response factor

A_x = area of the characteristic ion for the compound being determined

A_{is} = area of the characteristic ion for the specific internal standard

C_{is} = concentration of the internal standard [ng /ul]

C_x = concentration of the compound to be measured [ng /ul]

The response factor for all of the *calibration check compounds*, must fall within certain prescribed limits for the standardization to be acceptable. The relative standard deviation [%RSD] must be calculated for compounds identified as Calibration Check Compounds:

$$\%RSD = \frac{\sigma}{x} \times 100$$

must be within 25% of the predicted RF. If this continuing calibration standard does not meet the criteria of acceptability, the instrument should be evaluated, corrective action taken, and the standard repeated. No analysis can begin until the problem has been corrected.

7.3.3.3 Standardization of the Gas Chromatograph

Before analysis using the gas chromatograph a five point standard curve must be run beginning with a standard near the detection limit of the analysis being performed.

The response factors are calculated for each compound at each concentration level and these factors are averaged. The mean response factor is used to calculate concentrations of the compounds of interest. The %RSD should be less than 30% for these RF's. A daily standard should fall within 15% of the average response factor for the compounds being analyzed. If unknown samples exceed the range of the standard curve it should be appropriately diluted and re-analyzed.

7.3.4 Calibration of the Inductively Coupled Plasma Emission Spectrometer [ICP]

The ICP should be calibrated daily by profiling the instrument against a mercury lamp and centering the mercury line within the instrument slit.

The instrument is standardized by aspirating solutions containing metals which are to be determined. The standards should be certified by an independent source. A blank and one standard are sufficient for the standardization; however, a solution containing metals at a concentration near the linearity limit for each channel should be analyzed once per day to certify upper range linearity. The values should read within 10% of the theoretical concentration.

Once the value of the standard in mg/l is programmed into the computer, the instrument will output results for the unknowns in mg/l.

The calibration standard should be analyzed every 10 samples. The calibration should not change more than 10% during the analysis or the instrument should be recalibrated.

An independent verification standard should be assayed once the instrument has calibrated to verify that the standards used are of the proper concentration. This verification standard should read within 10% of its prescribed value.

One of the more prominent errors associated with analysis using the ICP is the inter-element interference. This instrument must be demonstrated to be free of inter-element interferences by aspirating the inter-element interference check solution before analyses can begin. The concentrations of the elements that comprise the check solution are listed in table 7-5. The elements placed in solution, to be shown free of interference, should read within 20% of the target value.

To further demonstrate the lack of matrix interferences, one sample of each group or one of twenty samples should be diluted 1:4 with water and re-analyzed. The value corrected for dilution should be within 10% of the original value. If there is poor correlation, the data for that matrix should be flagged or should be determined by the method of additions.

The ICP suffers from a lack of sensitivity for some elements and should be closely monitored. Table 7-6 lists the acceptable detection limits for the ICP in our laboratory.

Duplicates and spikes should be assayed every 20 samples and the statistics generated from such data should be properly organized and filed for easy inspection.

7.3.5 Atomic Absorption Spectrometer

The atomic absorption spectrometer should be standardized with a four point standard curve for each batch of samples. As with the ICP, standards should be verified by an independent source and should be confirmed in-house by using standards from different vendors.

All EPTOX and any sample showing matrix interferences will be analyzed by the method of standard additions.

Samples will be spiked and duplicated at a frequency of 1 in 20. The data generated will be tabulated and filed for easy inspection. Values of the final spiking solutions are found in table 7-7.

7.4 PERIODIC CALIBRATION

Balances, furnaces, spectrophotometers, etc... will be calibrated as part of the overall QA program and documentation will be maintained for these units.

7.4.1 Balances

Analytical balances are calibrated daily using weights traceable to the NBS. The weights are class S or better. Additionally, an independent assessment of the accuracy of the balances will be performed by a factory representative each year.

7.4.2 Thermometers

All thermometers used in the laboratory will be calibrated against a NBS thermometer and will be shown to be [+ or -] 2 degrees C. Calibrations will be checked on an annual basis.

7.4.3 Hoods

All hoods will be checked periodically for proper air flow and hidden air currents.

7.4.4 Meter

All pH and conductivity meters will be calibrated routinely. [Daily with each use].

TABLE 7-1

DFTPP KEY IONS AND ION ABUNDANCE CRITERIA

<u>MASS</u>	<u>ION ABUNDANCE CRITERIA</u>
51	30 - 60 percent of mass 198
68	less than 2 percent of mass 69
70	less than 2 percent of mass 69
127	40 - 60 percent of mass 198
197	less than 1.0 percent of 198
198	base ion, 100% relative abundance
199	5 - 9 percent of 198
275	10 - 30 percent of mass 198
365	greater than 1% of mass 198
441	present but less than 443
442	greater than 40% of 198
443	17 - 23 percent of mass 442

TABLE 7-2

BFB KEY IONS AND ABUNDANCE CRITERIA

<u>MASS</u>	<u>ION ABUNDANCE CRITERIA</u>
51	15 - 40 percent of the base peak
75	30 - 60 percent of the base peak
95	base peak, 100% relative abundance
96	5 - 9 percent of the base peak
173	less than 1% of the base peak
174	greater than 50 percent of base peak
175	5 - 9 percent of mass 174
176	greater than 95 percent but less than 101 percent of 174
177	5 - 9 percent of mass 176

TABLE 7-3

VOLATILE INTERNAL STANDARDS WITH CORRESPONDING
ANALYTES ASSIGNED FOR QUANTIFICATION

<u>BROMOCHLOROMETHANE</u>	<u>1,4-DIFLUOROBENZENE</u>	<u>CHLOROBENZENE -d5</u>
Chloromethane	2- butanone	2- hexanone
Bromomethane	1, 1, 1- trichloroethane	4- methyl - 2 -pentanone
Vinyl Chloride	Carbon Tetrachloride	Tetrachloroethene
Chloroethane	Vinyl Acetate	1, 1, 2, 2 - tetrachloroethane
Methyl chloride	Bromodichloromethane	Toluene
Acetone	1, 2- dichloropropane	Chlorobenzene
Carbon Disulfide	t -1, 3- dichloropropene	Ethylbenzene
1, 1- Dichloroethene	Trichloroethane	Styrene
1, 1- Dichloroethane	Dibromochloromethane	Xylene
t -1, 2- Dichloroethene	1, 1, 2- trichloroethane	Bromofluorobenzene
Chloroform	Benzene	Toluene d8
1, 2 -Dichloroethane	c -1, 3- Dichloropropene	
1, 2 -Dichloroethane d4	2 -Chloroethyl Vinyl Ether	
	Bromoform	

SEMIVOLATILE INTERNAL STANDARDS WITH CORRESPONDING
ANALYTES ASSIGNED FOR QUANTITATIONS

1, 4 -DICHLOROBENZENE

N -nitrosodimethylamine
Phenol
Aniline
Bis [2 -chloroethyl] ether
2 -Chlorophenol
1, 1-Dichlorobenzene

1, 4 -Dichlorobenzene
Benzyl Alcohol
1, 2 -Dichlorobenzene
2 -Methylphenol
Bis [2 -chloroisopropyl] ether
Methylphenol
N -nitroso-di-n-propylamine
Hexachloroethane
2 -Fluorophenol
Phenol d6

NAPHTHALENE d8

Nitrobenzene
Isophorone
2 -Nitrophenol
2, 4 -dimethylphenol
Benzoic Acid
Bis [2 -chloroethoxy]
methane
2, 4 -Dichlorophenol
1, 2, 4 -Trichlorobenzene
Naphthalene
4 -Chloroaniline
Hexachlorobutadiene
4 -Chloro-1-methylphenol
2 -Methylnaphthalene
Nitrobenzene d5

ACENAPTHENE d10

Hexachlorocyclopentadiene
2, 4, 6 -Trichlorophenol
2, 4, 5 -Trichlorophenol
2 -Chloronaphthalene
2 -Nitroaniline
Dimethylphthalate

Acenaphthylene
3 -Nitroaniline
Acenaphthene
2, 4 -Dinitrophenol
4 -Nitrophenol
Dibenzofuran
2, 4 -Dinitrotoluene
2, 6 -Dinitrotoluene
Diethylphthalate
4 -chlorophenylphenylether
Fluorene
4 -Nitroaniline
2 -Fluorobiphenyl
2, 4, 6 -Tribromophenol

PHENANTHRENE

4, 6 -Dinitro-2-methylphenol
4 -Nitrosodiphenylamine
1, 2-Diphenylhydrazine
4 -Bromophenylphenylether
Hexachlorobenzene
Pentachlorophenol
Phenanthrene
Anthracene
Di-n-butylphthalate
Fluoranthene

CHRYSENE d12

Benzidine
Pyrene
Butylbenzylphthalate
3, 3' -Dichlorobenzidine
Benzo [a] anthracene
bis-2-ethylhexylphthalate
Chrysene
Terephenyl d14

PERYLENE d12

Di-n-octylphthalate
Benzo [b] fluoranthene
Benzo [k] fluoranthene
Benzo [a] pyrene
Indeno [1,2,3-c, d] pyrene
Dibenz [a,h] anthracene
Benzo [g,h,i] perylene

TABLE 7-5

CALIBRATION CHECK COMPOUNDS

<u>BASE / NEUTRAL FRACTION</u>	<u>ACID FRACTION</u>	<u>VOLATILE FRACTION</u>
Acenaphthene	4 -Chloro-3-methylphenol	1, 2 -Dichloroethene
1, 4 -Dichlorobenzene	2, 4 -Dichlorophenol	Chloroform
Hexachlorobutadiene	2 -Nitrophenol	1, 2 -Dichloropropane
N-Nitroso-di-n-phenylamine	Phenol	Toluene
Di -n-octylphthalate	Pentachlorophenol	Ethylbenzene
Fluoranthene	2, 4, 6 -Trichlorophenol	Vinyl Chloride
Benzo [a] pyrene		

TABLE 7-6

SPIKING LEVELS FOR METAL AND CYANIDE ANALYSIS

<u>ELEMENT</u>	<u>CONCENTRATION</u>
Aluminum	400
Antimony	100
Arsenic	400
Barium	400
Beryllium	10
Cadmium	10
Calcium	NR
Chromium	40
Cobalt	100
Copper	50
Iron	200
Lead	100
Magnesium	NR
Manganese	100
Mercury	1.0
Nickel	100
Potassium	NR
Selenium	400
Silver	10
Sodium	NR
Thallium	400
Vanadium	100
Zinc	100
Cyanide	100

All values are in ug/ L in the final digestate of the spiked sample.

NR = not required

Elements without spike levels and not designated NR should be spiked at appropriate levels.

TABLE 7-7

INTER-ELEMENT INTERFERENCE CHECK SAMPLE
ELEMENT CONCENTRATION

<u>ANALYTES</u>	<u>[mg/L]</u>	<u>INTERFERENTS</u>	<u>[mg/L]</u>
Ba	0.5	Al	500
Be	0.5	Ca	500
Cd	1.0	Fe	200
Co	0.5	Mg	500
Cr	0.5		
Cu	0.5		
Mn	0.5		
Ni	1.0		
Pb	1.0		
V	0.5		
Zn	1.0		

8.0 QUALITY CONTROL SAMPLE ASSAY

8.1 INTRODUCTION

This section deals with samples routinely added to the normal laboratory sample stream which demonstrates the accuracy and precision of the laboratory's analysis to be within acceptable limits. These samples will form the basis for calculating statistical data which can be plotted on a control chart.

The QC samples will be analyzed as recommended within this section unless there are specific methodological requirements.

8.2 TYPES OF QUALITY CONTROL SAMPLES

8.2.1 Field blank

It is possible to contaminate samples during the collection and transport to the laboratory even though the sample may be sealed in laboratory provided containers. For this reason, samples of laboratory grade water are placed into appropriately preserved bottles and taken through the collection process. These field blanks should always be transported and stored with the sample group with which it is associated. Results of the field blank analysis is to be kept with the sample analytical data package.

8.2.2 Reagent Blank

To verify that the method is free of contamination from reagents, glassware, and solvents, a volume of laboratory grade water or a purified solid matrix will be taken through the entire analytical procedure. It would be ideal to have none of the components of interest detected in the reagent blank; however, a limit of 2x the instrument detection limit is a practical goal. There are some common laboratory compounds that will sometimes be found in the blank in concentrations above the method quantitation limits. The specific method will address those situations and proper courses of action.

8.2.3 Duplicate Samples

To assess the precision of the analysis, duplicate samples are assayed. The relative percentage differences are calculated and plotted on a control chart. This should be done once in every twenty samples or whenever a group of five or more samples are analyzed. In the analysis of metals these duplicates are not spiked. For organics analysis the duplicates are the MS [matrix spike] and MSD [matrix spike duplicate].

8.2.4 Surrogate Standards

Surrogate standard analyses should be performed on GC and GC/MS analyses. These compounds should be added to the water or solid sample before extraction. The recoveries of these samples should be

plotted on a control chart. These values should be available to the client upon request.

8.2.5 Matrix Spike

To evaluate the effects of a particular matrix upon the recovery of the analytes in question, one sample of each matrix type or one of each group of twenty samples is spiked with appropriate compounds and is carried through the entire procedure. Recovery of these compounds is calculated and should fall within previously determined ranges. Data associated with matrix spikes which are not within limits should be called to the attention of the area supervisor. The options are to report the data with appropriate explanations or to re-extract the samples.

8.2.6 Blind Samples

Once per quarter the QA officer will place into the laboratory analysis stream samples for which only he knows the analytical value. The results will be taken through the standard analytical process and the data given to the QA officer.

8.2.7 Control Sample

A commercially prepared quality control sample should be analyzed with each group to monitor procedure efficiency. The assayed value of the control should be within established acceptable ranges.

9.0 ANALYTICAL PROCEDURES

9.1 DEFINITION

The analytical method should be a detailed procedure for the analysis of various matrices for specific compounds and should include the following items:

1. Method name and matrix applicability
2. Collection procedures, e.g., preservatives required, filtration, and transport requirements
3. Storage requirements and holding times
4. Analytical techniques to be involved in the analysis
5. Reagent and standard preparation
6. Instrument specifics, e.g., columns to be used, temperature, etc...
7. Expected instrumental response
8. Limitations of the procedure
9. Calibration techniques and frequency
10. Quality control
11. References
12. Calculations

9.2 APPROVED ANALYTICAL METHODS

Whenever possible the laboratory will use the methods contained in USEPA documents, e.g., SW-846. A complete listing of approved methodology is contained in table 9-1. Complete EPA methods will be available to the analyst. However, specific methodologies will be written, which are specific to this laboratory, and will be kept in the operational vicinity. These methods cannot be altered in any way without documentation and approval of the area supervisor and the laboratory director. Methods should be chosen that will meet the clients regulatory requirements. RCRA compliance requires SW-846 methods while NPDES requires the 600 series methods.

Before any analyst is allowed to report data using a specific method, it must be documented that he has attained an acceptable level of proficiency using that method. This will be filed in the personnel file.

TABLE 9-1

APPROVED INORGANIC TEST PROCEDURES

<u>PARAMETER</u>	<u>UNITS</u>	<u>METHOD</u>	<u>REFERENCE</u>
		EPA	STD METH
Acidity, as calcium Carbonate		305.1	402
mg/l			
phenolphthalein end point			
Alkalinity, as Calcium Carbonate		310.1	403
mg/l			
pH 4.5 end-point			
Aluminum			
mg/l or mg/kg			
GF-AA	202.1		304
ICP-ES	6010		
Ammonia Nitrogen			
mg/l			
electrode	350.3		
phenate colorimetric	350.1		417
Antimony			
mg/l or mg/kg			
GF-AA	204		304
ICP-ES	6010		
Arsenic			
mg/l or mg/kg			
GF-AA [Zeeman]	7060		304
Hydride-AA	7061		303
Barium			
mg/l or mg/kg			
GF-AA	208		304
ICP-ES	6010		

Beryllium

mg/ l or mg/ kg

GF-AA

210

304

ICP-ES

6010

Biological Oxygen Demand [BOD]

mg/ l

DO electrode

405

507

Boron

mg/ l or mg/ kg

ICP-ES

6010

Cadmium

GF-AA

7131

304

F-AA

7130

ICP-ES

6010

Calcium

mg/ l or mg/ kg

F-AA

7140

303

ICP-ES

6010

Chemical Oxygen Demand

mg/ l

manual titrimetric

410

508

Chloride

mg/ l

colormetric

325

407

Chlorine

mg/ l

DPD Spectrophotometric

330

408

Chromium VI

mg/ l

extraction and AA

218

303

Chromium

mg/ l or mg/ kg

GF-AA

7191

303

ICP-ES

6010

Cobalt

mg/ l or mg/ kg

GF-AA

7201

303

ICP-ES

6010

Color

Platinum Cobalt Units

Platinum Cobalt

110

204

Copper

mg/ l or mg/ kg

F-AA

7210

303

GF-AA

304

ICP-ES

6010

Cyanide

mg/ l or mg/ kg

manual distillation with

colorimetric determination

9010

412

Flouride

mg/ l

SPADNS

340

413

Hardness as Calcium Carbonate

mg/ l

ICP-ES

6010

Iron

mg/ l or mg/ kg

ICP-ES

6010

Kjeldahl Nitrogen

mg/ l

distillation with phenate colorimetric

351.3

417

Lead

mg/ l or mg/ kg

GF-AA

7421

303

ICP-ES

6010

Magnesium

mg/ l or mg/ kg

F-AA

7450

303

ICP-ES

6010

Manganese

mg/ l

GF-AA

243

304

ICP-ES

6010

Mercury

mg/ l

manual cold vapor

7470

303

Molybdenum

mg/ l

GF-AA

7481

304

ICP-ES

6010

Nickel

mg/ l mg/ kg

GF-AA

249

304

ICP-ES

6010

Nitrate nitrogen

mg/ l

Ion chromatography

9200

Oil and grease

mg/ l

Gravimetric

413.1

503

Organic Carbon

mg/ l

combustion an IR determination

9060

505

Organic Halogen		
mg/ l		
combustion and titration	9020	
Phenols		
mg/ l		
distillation and 4AAP colormetric	9066	420.1
Potassium		
mg/ l or mg/ kg		
ICP-ES	6010	
Selenium		
mg/ l or mg/ kg		
GF-AA	7740	304
Hydride-AA	7741	
Silver		
mg/ l or mg/ kg		
GF-AA	7760	303
ICP-ES	6010	
Sodium		
mg/ l or mg/ kg		
ICP-ES	6010	
Solids, total		
mg/ l		
gravimetric	160.3	209a
Solids, suspended		
mg/ l		
gravimetric	160.1	209.b
Solids, dissolved		
mg/ l		
gravimetric	160.2	209d
Solids, volatile		
mg/ l	160.4	209e

Specific Conductance		
umhos/ cm		
wheatstone bridge	120	
Sulfate		
mg/ l		
turbidimetric		
Ion Chromatography	375	426c
Thallium		
mg/ l or mg/ kg		
GF-AA	7841	304
ICP-ES	6010	
Tin		
mg/ l or mg/ kg		
GF-AA	282	304
ICP-ES	6010	
Titanium		
mg/ l or mg/ kg		
ICP-ES	6010	
Turbidity		
NTU		
nephelometric	180	214
Vanadium		
mg/ l or mg/ kg		
ICP-ES	6010	
Zinc		
mg/ l or mg/ kg		
GF-AA	289	304
F-AA	7950	
ICP-ES	6010	

PARAMETEREPA METHOD NUMBER
EPA / 600 SW-846

Acenaphthene	625	1625	8250	8270
Acenaphthylene	625	1625	8250	8270
Acrolein	624	1624	8240	
Acrylonitrile	624	1624	8240	
Anthracene	625	1625	8250	8270
Benzene	624	1624	8240	
Benzo[a]anthracene	625	1625	8250	8270
Benzo[a]pyrene	625	1625	8250	8270
Benzo[b]fluoranthene	625	1625	8250	8270
Benzo[g,h,i]perylene	625	1625	8250	8270
Benzo[k]fluoranthene	625	1625	8250	8270
Benzylbutylphthalate	625	1625	8250	8270
Bis[2-chloroethoxy]methane	625	1625	8250	8270
Bis[2-chloroethyl]ether	625	1625	8250	8270
Bis[2-ethylhexyl]phthalate	625	1625	8250	8270
Bromodichloromethane	624	1624	8240	
Bromoform	624	1624	8240	
Bromomethane	624	1624	8240	
4-Bromophenylphenylether	625	1625	8250	8270
Carbon tetrachloride	624	1624	8240	
4-Chloro-3-methylphenol	625	1625	8250	8270
Chlorobenzene	624	1624	8240	
Chloroethane	624	1624	8240	
2-Chloroethylvinyl ether	624	1624	8240	
Chloroform	624	1624	8240	
Chloromethane	624	1624	8240	
2-Chloronaphthalene	625	1625	8250	8270
2-Chlorophenol	625	1625	8250	8270
2-Chlorophenylphenyl ether	625	1625	8250	8270
Chrysene	625	1625	8250	8270
Dibenzo[a,h]anthracene	625	1625	8250	8270
Dibromochloromethane	624	1624	8240	
1,2-Dichlorobenzene	625	1625	8250	8270
1,3-Dichlorobenzene	625	1625	8250	8270
1,4-Dichlorobenzene	625	1625	8250	8270
3,3'-Dichlorobenzidine	625	1625	8250	8270
Dichlorodifluoromethane	624	1624	8240	

1,1-Dichloroethane	624	1624	8240
1,2-Dichloroethane	624	1624	8240
1,1-Dichloroethene	624	1624	8240
trans-1,2-Dichloroethene	624	1624	8240
2,4-Dichlorophenol	625	1625	8250 8270
1,2-Dichloropropane	624	1624	8240
cis-1,3-Dichloropropene	624	1624	8240
trans-1,3-Dichloropropene	624	1624	8240
Diethylphthalate	625	1625	8250 8270
2,4-Dimethylphenol	625	1625	8250 8270
Dimethylphthalate	625	1625	8250 8270
Di-n-butylphthalate	625	1625	8250 8270
Di-n-octylphthalate	625	1625	8250 8270
2,4-Dinitrophenol	625	1625	8250 8270
2,4-Dinitrotoluene	625	1625	8250 8270
2,6-Dinitrotoluene	625	1625	8250 8270
Ethylbenzene	624	1624	8240
Fluoranthene	625	1625	8250 8270
Fluorene	625	1625	8250 8270
Hexachlorobenzene	625	1625	8250 8270
Hexachlorobutadiene	625	1625	8250 8270
Hexachlorocyclopentadiene	625	1625	8250 8270
Hexachloroethane	625	1625	8250 8270
Indeno[1,2,3-cd]pyrene	625	1625	8250 8270
Isophorone	625	1625	8250 8270
Methylene Chloride	624	1624	8240
2-Methyl-4,6-dinitrophenol	625	1625	8250 8270
Napthalene	625	1625	8250 8270
Nitrobenzene	625	1625	8250 8270
2-Nitrophenol	625	1625	8250 8270
4-Nitrophenol	625	1625	8250 8270
N-nitrosodimethylamine	625	1625	8250 8270
N-nitrosodi-n-propylamine	625	1625	8250 8270
N-nitrosodiphenylamine	625	1625	8250 8270
2,2-oxybis[1-chloropropane]	625	1625	8250 8270
PCB 1016	608		8080
PCB 1221	608		8080
PCB 1232	608		8080
PCB 1242	608		8080
PCB 1248	608		8080
PCB 1254	608		8080

Revised date 2/91

PCB 1260	608		8080
Pentachlorophenol	625	1625	8250 8270
Phenanthrene	625	1625	8250 8270
Phenol	625	1625	8250 8270
Pyrene	625	1625	8250 8270
1,1,2,2-Tetrachloroethane	624	1624	8240
Tetrachloroethene	624	1624	8240
Toluene	624	1624	8240
1,2,4-Trichlorobenzene	625	1625	8250 8270
1,1,1-Trichloroethane	624	1624	8240
1,1,2-Trichloroethane	624	1624	8240
Trichloroethene	624	1624	8240
Trichlorofluoromethane	624	1624	8240
2,4,6-Trichlorophenol	625	1625	8250 8270
Vinyl Chloride	624	1624	8240

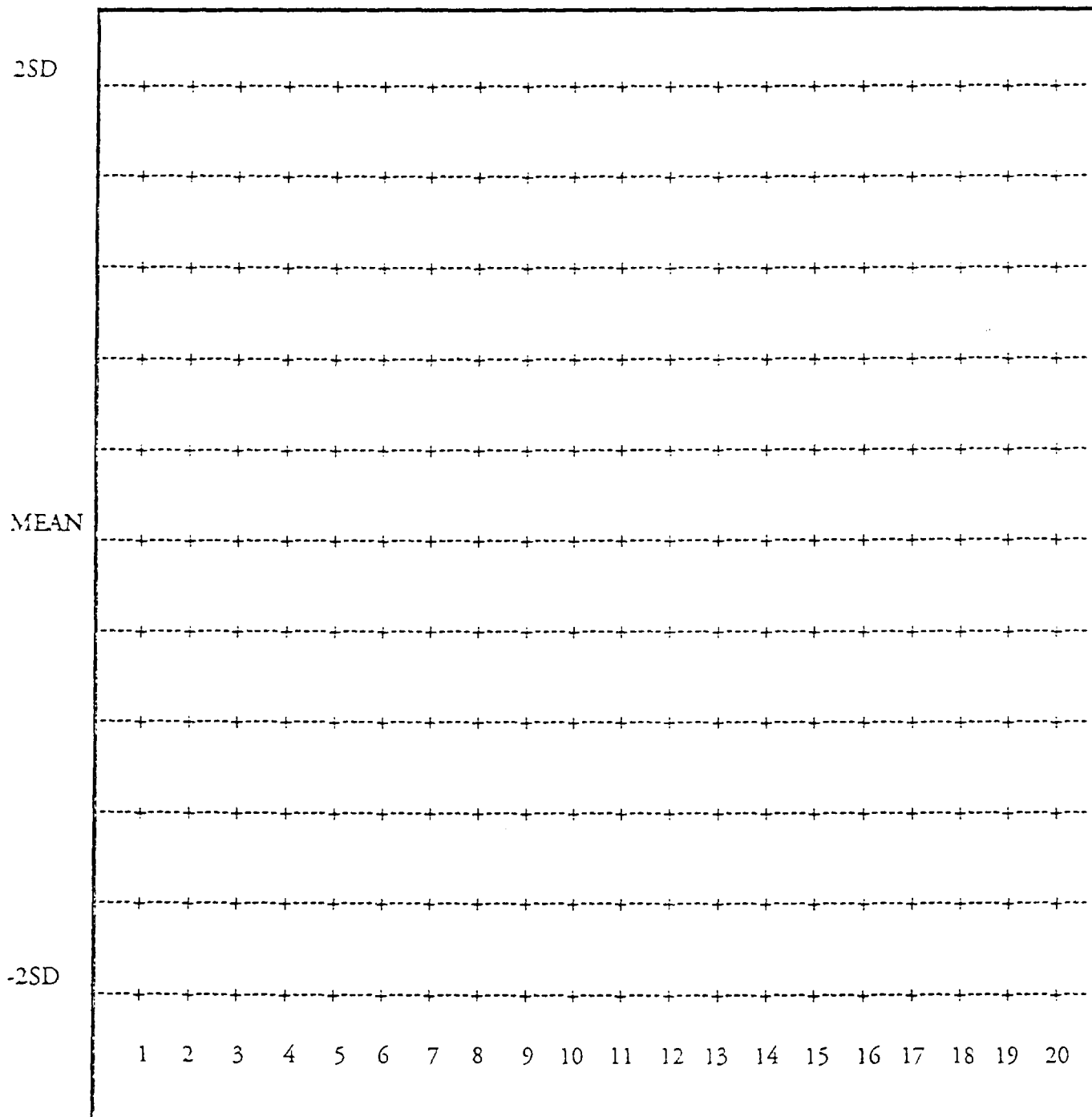
Halogenated Pesticides	608	8080
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2 4 0495
QUALITY CONTROL

ANALYSIS _____

DATES _____

PARAMETER PLOTTED _____



10.0 DATA VERIFICATION

10.1 PURPOSE

Data verification is the process used within the laboratory to insure that the results reported are correct representations of the assays performed. This can basically be broken down into the following sections:

1. The processing of QC sample results to demonstrate that assays have met prescribed criteria for accuracy and precision.
2. Data validation to insure that the calculations are correct and that the calculated results are reported correctly.

10.2 PROCESSING QUALITY CONTROL DATA

10.2.1 Procedures to access Data Precision and Accuracy

There are general procedures used throughout the laboratory to evaluate accuracy and precision. These procedures will be covered in detail in the description of the method.

1. Reagent blanks are prepared and analyzed with each group of samples or every 20 samples.
2. Field blanks are analyzed at the request of the client and should be included with every field sample group.
3. Standard curves are generated to insure linearity of response. The curves are valid until the continuing calibration sample fails to meet set criteria.
4. One sample in 20 is analyzed in duplicate.
5. One sample in 20 is spiked with the analyte in question.
6. Samples are spiked with appropriate surrogate compounds to access recovery.
7. Internal standards are added to all samples for GC/ MS analysis.

When the assay is completed the review process begins and will follow the following path:

1. The reagent blank is checked for the presence of interferences. The concentration of target compounds in the blank should not be high enough to cause a significant change in the unknown

values. If it is contaminated, the analytical system should be cleaned and the samples repeated.

2. The field blank should be checked for contamination. If the reagent blanks and the method blanks are free from contamination, the result for the field blank should be reported with the sample group.
3. The calibration curve should be evaluated to insure that the values for linearity and agreement are within acceptable limits. The daily standard should be checked for agreement with the five point standard curve.
4. The RPD between the replicate analyses should be checked to see that the value is within acceptable limits.
5. The percent recovery of the matrix spike is calculated and compared to the acceptable limits set by the QA officer.
6. The recovery of the surrogate standards are compared to the true value and to the limits of acceptability. The limits of acceptability are listed in table 10-1.

10.2.2 Statistical Quality Control

The precision and accuracy of each method is calculated and tabulated. This data is updated monthly. The data will be graphically represented by using control charts. Generally, two standard deviations will be used as the control limits. The up-keep of the QC charts will be the responsibility of the area supervisor and will be reviewed and collected monthly by the QA officer.

10.2.2.1 Precision

To determine the precision of a method, a program of replicate analyses is performed. These results are used to calculate the %RPD.

RPD for replicate analyses is defined as 100 times the difference between the members of the replicate set divided by the mean of the two numbers. The %RPD of two values, D1 and D2, would be calculated:

$$\%RPD = \frac{D1 - D2}{[D1 + D2] / 2} \times 100$$

When the RPD is obtained for at least ten replicate pairs, the average RPD and the standard

deviation is calculated using the following formulas:

$$M = \frac{\Sigma m_1 \dots m_n}{n}$$

$$S_m = \left[\frac{\Sigma [m-M]^2}{n-1} \right]^{1/2}$$

where:

m = the RPD of a replicate pair

M = the average of the RPD determinations

S_m = the standard deviation of the data set of RPD determinations

n = the number of determinations

The control chart should be constructed such that the acceptable limits are $[+ / -]$ two standard deviations. Each of the daily or group RPD values are plotted on the chart with the actual numeric value printed by the mark on the graph. All data should be plotted whether it is within the two standard deviation range or not. Values falling outside the two standard range should have some notation as to the corrective action taken by the analyst on that occasion.

10.2.2.2 Analytical Accuracy

Analytical accuracy is to be monitored along with precision. The accuracy of the method is monitored by using the data from the spike sample recoveries. This parameter is termed the %R and is calculated as follows:

$$\%R = \frac{O - S}{T} \times 100$$

where:

%R = the percent recovery

O = the analytically determined spiked sample concentration

S = the true sample concentration

T = the true concentration of the spike

The true concentration is calculated from the following equation:

$$T = \frac{\text{Spike concentration in mg/l} \times \text{volume of spike in ml}}{\text{Volume of sample in ml} + \text{Volume of Spike in ml}}$$

When the percent recovery is obtained for at least ten samples, the mean percent recovery and the standard deviation are calculated:

$$\%R_m = \frac{\Sigma \%R \dots \%R_n}{n}$$

$$S_r = \left[\frac{\Sigma [\%R_n - \%R_m]^2}{n - 1} \right]^{1/2}$$

where:

%R _m =	the mean percent recovery
%R _n =	the percent recovery of a single pair
n =	the number of results
Sr =	the standard deviation of the data set percent recovery determination

A control chart is drawn with limits of acceptability at $[+/-] 2 \text{ SD}$. The %R values are listed on the Y axis and the data assayed is listed on the X axis.

10.3 DATA VALIDATION

Validation of data begins with the analytical chemist performing the assay and ends with the final review by the laboratory manager. The following steps are taken once raw data is generated by the analyst:

1. Calculations for the final reportable data are made and recorded on a sheet to be included in the data package.
2. Quality control data is calculated and plotted.
3. Data is reviewed and signed by the area supervisor.
4. Data is input into the laboratory computer.
5. All data generated for the sample set is placed into a folder labeled with the project number.
6. Reports are generated and reviewed by the area supervisor.
7. Reports are reviewed by the laboratory manager.

10.4 CORRECTION OF ERRONEOUS DATA

If it is confirmed that erroneous data has been released, the following procedure should be followed:

1. Notify the laboratory manager.

2. The laboratory manager or his designer will notify the client by phone.
3. An amended report will be issued.
4. Documentation will be filed in the project file.

11.0 ANALYTICAL REPORT

The standard results report issued to the client will include the following items:

1. Sample description
2. Laboratory I.D. number
3. Date collected
4. Date reported
5. Date received
6. Test results and units

The final results report is checked by the area supervisors and finally by the laboratory manager before distribution to the client.

12.0 RECORD MANAGEMENT

12.1 DISCUSSION

The quality assurance program has been designed and implemented at Specialized Assays to help provide the data of known, high quality to our clients. The fact that this program has been followed must be demonstrated by the maintenance of specific documents that relate to the analytical processes. These documents become part of the permanent record maintained by the laboratory.

The quality control records are classified into two broad categories:

1. *Project Specific Documents:* These records pertain to a particular project or group of samples with a project, e.g., raw data, duplicate analysis, etc.
2. *General Laboratory Documents:* These documents reflect the efforts of the staff to maintain general laboratory operations and equipment such that data obtained from these instruments is not compromised. Examples of general laboratory documents are wavelength calibration of spectrophotometers, temperatures, etc.

There may be specific requirements for data and record storage based upon the project under way but general guidelines for record keeping will be addressed.

12.2 PROJECT RECORDS

A separate package of data and records are kept for each project. These projects will be filed by the laboratory billing control number which serves as a project number. Since different areas in the laboratory may be involved with the same set of samples, there may be project files for that specific project in several areas of the laboratory. The following files may be developed:

1. **Accessioning Files:**

Files on a particular project maintained by the sample accessioning area will contain information concerning sample collection and transport. Included will be the chain of custody document, any supporting written instructions, and notes of any conversation between the laboratory personnel and the client or his representative. Also filed in accessioning will be the results of any analysis which must be referred to another laboratory. These files may be maintained by client rather than by project unless otherwise specified by the contract. Generally these records are filed by client and project number.

2. **Sample Preparation Files**

Files maintained by the sample preparation laboratories will include all records of extraction or

digestion. This will include volumes, weights, and anomalies noted in the preparation, etc. These prep sheets may be copied and distributed to the department, but the original record stays in the prep lab files.

3. Departmental Data:

Each department should maintain a file for each project that will include the following items:

- a. A copy of the sample preparation sheet.
- b. A sample tracking sheet with the sample identification, date prepared, analysis requested.
- c. A sheet showing final results and all calculations made in determining data.
- d. Notes as to any anomalies noted in the analysis.
- e. All raw data, e.g., instrument readings, strip chart, recordings, chromatograms, etc.
- f. Records of controls, e.g., duplicates, spikes, surrogates, etc.
- g. Pointers to other data packages that might have a bearing on the data included.

Before the data package is filed, the signature of the analyst and the reviewing supervisor must be obtained.

12.3 GENERAL LABORATORY RECORDS

The general laboratory records should be filed chronologically within a file associated with the instrument or laboratory function. These files will be inspected and periodically taken to permanent storage by the QA officer. The QA officer will file the records chronologically by function for easy reference. Examples of the records are:

1. QA charts
2. Instrument function checks
3. Temperature charts
4. QC sample analysis

Results of the proficiency check samples will be filed for easy review. These results should be reviewed and filed by the QA officer after initial review by the area supervisors.

12.4 RECORD RETENTION

All records generated by the laboratory will be maintained for a period of seven years. If specific requirements indicate a longer storage, this should be noted before the analysis begins. All such files are tagged as special files and will not be destroyed.

12.5 SAMPLE STORAGE

All samples will be stored in the laboratory for one month after the report has been generated. After this time all samples will be discarded.

13.0 NONCONFORMANCE AND CORRECTIVE ACTION

Any event that is beyond previously established acceptable limits is considered a nonconformance. This nonconformance may or may not be detectable by normal laboratory procedures and may or may not adversely affect data. However, every attempt is to be made to detect and correct nonconformance.

Nonconformance detected as a result of the statistical evaluation of QC data are readily recognizable and should be noted and reported by the analytical chemist responsible for the test. All nonconformances should be recorded and reported to the area supervisor whether or not the assay is reported.

Nonconformances that affect results should be called immediately to the attention of the QA officer and the laboratory manager. These reports should be in writing.

Nonconformances detected as a result of a routine QA audit by the QA officer should be reported immediately to the area supervisor with a written report to the laboratory manager. The area supervisor will correct the nonconformance and report in writing to the QA officer and the laboratory manager.

14.0 PERFORMANCE AUDITS

14.1 DEFINITION

It will be the responsibility of the QA officer to conduct periodic audits of the laboratory's adherence to the written QA protocol. These audits will be conducted at least annually and are to be reported to the laboratory manager.

14.2 IMPLEMENTATION

The QA officer will periodically introduce samples into the analysis stream. The results of these samples will be evaluated by the QA officer. A written report will be given to the area supervisors and to the laboratory manager. Any problems noted must be addressed by the area supervisors and a response given in writing to the QA officer and the laboratory manager. These become part of the permanent record of the laboratory.

The QA officer will periodically inspect the operation of the laboratory for the following items:

1. Sample maintenance
 - a. Are samples properly stored, e.g., refrigerated, etc?
 - b. Are holding times being observed?
2. Calibrations
 - a. Are instruments being properly calibrated on schedule?
 - b. Are all records of calibration being properly kept?
3. Maintenance
 - a. Is instrument maintenance up to date?
 - b. Has an instrument had repeated occurrences of the same problem?
4. Record Maintenance
 - a. Are data files properly organized and complete?
 - b. Is quality control properly recorded and plotted?

- c. Are nonconformances properly noted and corrected?

The results of this survey should be given to the area supervisor and to the laboratory manager. Any responses should be made to the QA officer with a copy being given to the laboratory manager.

15.0 SAFETY

15.1 GENERAL POLICY

Specialized Assays, Inc., recognizes that health maintenance is primarily the responsibility of the employee. The company will provide instruction and safety facilities within the laboratory to facilitate making the laboratory a safe place in which to work. Every effort will be made to prevent and control illness or injury to personnel.

15.2 SPECIFIC POLICIES

The following specific policies have been adopted by the laboratory:

1. An applicant's mental and physical capabilities will be considered in job placement.
2. Any accident or incident involving laboratory safety will be reported to the immediate supervisor and an incident or accident report will be completed.
3. Prompt medical care will be supplied in the case of injury.
4. A hazardous chemical awareness program will be maintained in accordance with 29 CFR 1910.1450.
5. Fire exits will be clearly marked.
6. Fire extinguishers will be placed in appropriate locations in the laboratory and training on their use will be provided.
7. Fire drills will be held quarterly.
8. A safety committee will be formed to review all facets of the laboratory's safety status.
9. All safety devices will be checked periodically and their operational status evaluated.

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ATTACHMENT D

PRECISION, ACCURACY, AND COMPLETENESS REQUIREMENTS

Compound	Water			Soil		
	Relative % Difference**	% Recovery Range*	% Completeness	Relative % Difference**	% Recovery Range*	% Completeness
<u>Volatiles</u>						
1,1-Dichloroethene	14	61-145	95	22	59-172	95
Trichloroethene	14	71-120	95	24	62-137	95
Benzene	11	76-127	95	21	66-142	95
Toluene	13	76-125	95	21	59-139	95
Chlorobenzene	13	75-130	95	21	60-133	95
<u>Semi-Volatiles</u>						
Phenol	42	12-89	95	35	26-90	95
2-Chlorophenol	40	27-123	95	50	25-102	95
1,4-Dichlorobenzene	28	36-97	95	27	28-104	95
N-Nitroso-di- n-propylamine	38	41-116	95	38	41-126	95
1,2,4-Trichlorobenzene	28	39-98	95	23	38-107	95
4-Chloro-3-methylphenol	42	23-97	95	33	26-103	95
Acenaphthene	31	46-118	95	19	31-137	95
4-Nitrophenol	50	10-80	95	50	11-114	95
2,4-Dinitrotoluene	38	24-96	95	47	28-89	95
Pentachlorophenol	50	9-103	95	47	17-109	95
Pyrene	31	26-127	95	36	35-142	95
<u>Pesticides</u>						
Lindane	15	56-12	95	50	46-127	95
Heptachlor	20	40-131	95	31	35-130	95
Aldrin	22	40-120	95	43	34-132	95
Dieldrin	18	52-126	95	38	31-134	95
Endrin	21	56-121	95	45	42-139	95
4,4' DDT	27	38-127	95	50	23-134	95

*Individual component recoveries of the matrix spike are calculated using:

$$\text{Matrix Spike Percent Recovery} = \frac{\text{SSR} - \text{SR}}{\text{SA}} \times 100$$

where:

SSR = Spike Sample Results

SR = First Sample Value

SA = Spike Added from spiking mix

** The relative percent difference (RPD) for each component is calculated using:

$$\text{RPD} = \frac{D1 - D2}{(D1 + D2)/2} \times 100$$

where:

RPD = Relative Percent Difference

D1 = First Sample Value

D2 = Second Sample Value (duplicate)

PRECISION, ACCURACY, AND COMPLETENESS REQUIREMENTS

FOR COMPOUNDS NOT SPIKED

FIELD MEASUREMENTS AND AIR MEASUREMENTS

Measurement	Water/Air			Soil		
	Relative % Difference**	% Recovery Range*	% Completeness	Relative % Difference**	% Recovery Range*	% Completeness
Volatile Organics	20	70-140	95	25	60-140	95
Semi-Volatile Organic	50	10-120	95	50	15-140	95
Pesticides/PCBs	25	50-130	95	50	35-140	95
Metals/Cyanide	SOW	SOW	95	SOW	SOW	95
Air	20	70-130	90	NA	NA	NA
pH/Field	0.2 units	0.1 unit	100	NA	NA	NA
Specific Conductance/ Field	5.0	NA	100	NA	NA	NA
Temperature/Field	0.5 Celcius	NA	100	NA	NA	NA

*Individual component recoveries of the matrix spike are calculated using:

$$\text{Matrix Spike Percent Recovery} = \text{SSR} - \text{SR} / \text{SA} \times 100$$

where:

SSR = Spike Sample Results

SR = First Sample Value

SA = Spike Added from spiking mix

** The relative percent difference (RPD) for each component is calculated using:

$$\text{RPD} = \text{D1} - \text{D2} / (\text{D1} + \text{D2}) / 2 \times 100$$

where:

RPD = Relative Percent Difference

D1 = First Sample Value

D2 = Second Sample Value (duplicate)

SOW = Values are given in the current CLP Statement of Work.

NA = Not Applicable.

ATTACHMENT E

METHOD DETECTION LIMITS FOR VOLATILE ORGANICS

Constituent	CAS Number	Reference Method	<u>Detection Limits</u>	
			Water (a) ug/l	Soil (b) ug/kg
Chloromethane	74-87-3	CLP-VOA	10	10
Bromomethane	74-83-9	CLP-VOA	10	10
Vinyl chloride	75-01-4	CLP-VOA	10	10
Chloroethane	75-00-3	CLP-VOA	10	10
Methylene chloride	75-09-2	CLP-VOA	5	5
Acetone	67-64-1	CLP-VOA	10	10
Carbon Disulfide	75-15-0	CLP-VOA	5	5
1,1-Dichloroethene	75-35-4	CLP-VOA	5	5
1,1-Dichloroethane	75-35-3	CLP-VOA	5	5
Trans-1, 2-Dichloroethene	156-60-5	CLP-VOA	5	5
Chloroform	67-66-3	CLP-VOA	5	5
1,2-Dichloroethane	107-06-2	CLP-VOA	5	5
2-Butanone	78-93-3	CLP-VOA	10	10
1,1,1-Trichloroethane	71-55-6	CLP-VOA	5	5
Carbon Tetrachloride	56-23-5	CLP-VOA	5	5
Vinyl Acetate	108-05-4	CLP-VOA	10	10
Bromodichloromethane	75-27-4	CLP-VOA	5	5
1,1,2,2-Tetrachloroethane	79-34-5	CLP-VOA	5	5
1,2-Dichloropropane	78-87-5	CLP-VOA	5	5
trans-1, 3-Dichloropropene	10061-01-5	CLP-VOA	5	5
Trichloroethene	79-01-6	CLP-VOA	5	5
Dibromochloromethane	124-48-1	CLP-VOA	5	5
1,1,2-Trichloroethane	79-00-5	CLP-VOA	5	5
Benzene	71-43-2	CLP-VOA	5	5
cis-1,3-Dichloropropene	10061-01-5	CLP-VOA	5	5
2-Chloroethyl Vinyl Ether	100-75-8	CLP-VOA	10	10
Bromoform	75-25-2	CLP-VOA	5	5
2-Hexanone	591-78-6	CLP-VOA	10	10
4-Methyl 2-Pentanone	108-10-1	CLP-VOA	10	10
Tetrachloroethene	127-18-4	CLP-VOA	5	5
Toluene	108-88-3	CLP-VOA	5	5
Chlorobenzene	108-90-7	CLP-VOA	5	5
Ethyl Benzene	100-41-4	CLP-VOA	5	5
Styrene	100-42-5	CLP-VOA	5	5
Total Xylenes	None	CLP-VOA	5	5

(a) Values listed are for Low Water Concentrations. Medium Water Contract Required Detection Limits (CRDL) for volatile TCL Compounds are 100 x the individual low water CRDL.

(b) Values listed are for Low Soil/Sediment Concentrations. Medium Soil/Sediment Contract Required Detection Limits (CRDL) for volatile TCL Compounds are 100 x the individual low soil/sediment CRDL.

METHOD DETECTION LIMITS FOR SEMIVOLATILE ORGANICS

Constituent	CAS Number	Reference Method	Detection Limits	
			Water (a) ug/l	Soil (b) ug/kg
Phenol	108-95-2	CLP-SV	10	330
bis (2-Chloroethyl) Ether	114-44-4	CLP-SV	10	330
2-Chlorophenol	95-57-8	CLP-SV	10	330
1,3-Dichlorobenzene	541-75-1	CLP-SV	10	330
1,4-Dichlorobenzene	106-46-7	CLP-SV	10	330
Benzyl Alcohol	100-51-6	CLP-SV	10	330
1,2-Dichlorobenzene	95-50-1	CLP-SV	10	330
2-Methylphenol	95-48-7	CLP-SV	10	330
bis(2-Chloroisopropyl) Ether	39638-32-9	CLP-SV	10	330
4-Methyl Phenol	106-44-5	CLP-SV	10	330
N-Nitroso-Dipropylamine	621-64-7	CLP-SV	10	330
Hexachloroethane	67-72-1	CLP-SV	10	330
Nitrobenzene	98-95-3	CLP-SV	10	330
Isophorone	78-59-1	CLP-SV	10	330
2-Nitrophenol	88-75-5	CLP-SV	10	330
2,4 Dimethylphenol	105-67-9	CLP-SV	10	330
Benzoic Acid	65-85-0	CLP-SV	10	1600
bis (2-chloroethoxy) methane	111-91-1	CLP-SV	10	330
2,4-Dichlorophenol	120-83-1	CLP-SV	10	330
1,2,4-Trichlorobenzene	120-82-1	CLP-SV	10	330
Napthalene	91-20-3	CLP-SV	10	330
4-Chloroaniline	106-47-8	CLP-SV	10	330
Hexachlorobutadiene	87-68-3	CLP-SV	10	330
4-Chloro-3-Methylphenol	59-50-7	CLP-SV	10	330
2-Methylnapthalene	91-57-6	CLP-SV	10	330
Hexachlorocyclopentadiene	77-47-4	CLP-SV	10	330
2,4,6-Trichlorophenol	88-06-2	CLP-SV	10	330
2,4,5-Trichlorophenol	95-95-4	CLP-SV	10	1600
2-Chloronaphthalene	91-58-7	CLP-SV	10	330
2-Nitroaniline	88-74-4	CLP-SV	10	1600
Dimethyl Phthalate	131-11-3	CLP-SV	10	330
Acenaphthylene	208-96-8	CLP-SV	10	330
3-Nitroaniline	99-09-2	CLP-SV	10	1600
Acenaphthene	83-32-9	CLP-SV	10	330
2,4-Dinitrophenol	51-28-5	CLP-SV	10	1600
4-Nitrophenol	100-02-7	CLP-SV	10	1600
Dibenzofuran	132-64-9	CLP-SV	10	330
2,4-Dinitrotoluene	121-14-2	CLP-SV	10	330
2,6-Dinitrotoluene	606-20-2	CLP-SV	10	330
Diethylphthalate	84-66-2	CLP-SV	10	330
4-Chlorophenyl Phenyl Ether	7005-72-3	CLP-SV	10	330

METHOD DETECTION LIMITS FOR SEMIVOLATILE ORGANICS

Constituent	CAS Number	Reference Method	Detection Limits	
			Water (a) ug/l	Soil (b) ug/kg
Fluorene	86-73-7	CLP-SV	10	330
4-Nitroaniline	100-01-6	CLP-SV	50	1600
4,6-Dinitro-2-Methylphenol	534-52-1	CLP-SV	50	1600
N-Nitrosodiphenylamine	86-30-6	CLP-SV	10	330
4-Bromophenyl-Phenyl Ether	101-55-3	CLP-SV	10	330
Hezachlorobenzene	118-74-1	CLP-SV	10	330
Pentachlorophenol	87-86-5	CLP-SV	50	1600
Phenanthrene	85-01-8	CLP-SV	10	330
Anthracene	120-12-7	CLP-SV	10	330
Di-n-butylphthalate	84-74-2	CLP-SV	10	330
Fluoranthene	206-44-0	CLP-SV	10	330
Pyrene	129-00-0	CLP-SV	10	330
Butyl Benzyl Phthalate	85-68-7	CLP-SV	10	330
3,3-Dichlorobenzidine	91-94-1	CLP-SV	20	660
Benzo(a)Anthracene	56-55-3	CLP-SV	10	330
bis(2-Ethylhexyl) Phthalate	117-81-7	CLP-SV	10	330
Chrysene	218-01-9	CLP-SV	10	330
Di-n-octyl Phthalate	117-84-0	CLP-SV	10	330
Benzo(b)Fluoranthene	205-99-2	CLP-SV	10	330
Benzo(k)Fluoranthene	207-08-9	CLP-SV	10	330
Benzo(a)Pyrene	50-32-8	CLP-SV	10	330
Indeno(1,2,3cd)Pyrene	193-39-5	CLP-SV	10	330
Dibenz(a,h)Anthracene	53-70-3	CLP-SV	10	330
Benzo(g,h,i)Perylene	191-24-2	CLP-SV	10	330

- (a) Values listed are for Low Water Concentrations. Medium Water Contract Required Detection Limits (CRDL) for semi-volatile TCL Compounds are 100 x the individual low water CRDL.
- (b) Values listed are for Low Soil/Sediment Concentrations. Medium Soil/Sediment Contract Required Detection Limits (CRDL) for semi-volatile TCL Compounds are 60 x the individual low soil/sediment CRDL.

METHOD DETECTION LIMITS FOR PESTICIDES AND PCBs

Constituent	CAS Number	Reference Method	Detection Limits	
			Water (a) ug/l	Soil (b) ug/kg
Alpha-BHC	319-84-6	CLP-PEST	0.05	8.0
Beta-BHC	319-85-7	CLP-PEST	0.05	8.0
Delta-BHC	319-86-8	CLP-PEST	0.05	8.0
Gamma-BHC (Lindane)	58-89-9	CLP-PEST	0.05	8.0
Heptachlor	76-44-8	CLP-PEST	0.05	8.0
Aldrin	309-00-2	CLP-PEST	0.05	8.0
Heptachlor Epoxide	1024-57-3	CLP-PEST	0.05	8.0
Endosulfan I	959-98-8	CLP-PEST	0.05	8.0
Dieldrin	60-57-1	CLP-PEST	0.10	16.0
4,4-DDE	72-55-9	CLP-PEST	0.10	16.0
Endrin	72-20-8	CLP-PEST	0.10	16.0
Endosulfan II	33213-65-9	CLP-PEST	0.10	16.0
4,4-DDD	75-54-8	CLP-PEST	0.10	16.0
Endosulfan Sulfate	1031-07-8	CLP-PEST	0.10	16.0
4,4-DDT	50-29-3	CLP-PEST	0.10	16.0
Endrin Ketone	53494-70-5	CLP-PEST	0.10	16.0
Methoxychlor	72-43-5	CLP-PEST	0.5	80.0
Chlordane	57-74-9	CLP-PEST	0.5	80.0
Toxaphene	8001-32-2	CLP-PEST	1.0	160.0
Aroclor-1016 (PCB)	12674-11-2	CLP-PEST	0.5	80.0
Aroclor-1221 (PCB)	11104-28-2	CLP-PEST	0.5	80.0
Aroclor-1232 (PCB)	11141-16-5	CLP-PEST	0.5	80.0
Aroclor-1242 (PCB)	53469-21-9	CLP-PEST	0.5	80.0
Aroclor-1248 (PCB)	12672-29-6	CLP-PEST	0.5	80.0
Aroclor-1254 (PCB)	11097-69-1	CLP-PEST	1.0	160.0
Aroclor-1260 (PCB)	11096-82-5	CLP-PEST	1.0	160.0

- (a) Values listed are for Low Water Concentrations. Medium Water Contract Required Detection Limits (CRDL) for pesticide TCL Compounds are 100 x the individual low water CRDL.
- (b) Values listed are for Low Soil/Sediment Concentrations. Medium Soil/Sediment Contract Required Detection Limits (CRDL) for pesticide TCL Compounds are 15 x the individual low soil/sediment CRDL.

METHOD DETECTION LIMITS FOR INORGANICS

Constituent	CLP Reference Method	Contract Requ'd Detection Levels (Ug/l) or (mg/kg)	Detection Levels (Ug/l) or ICP	Instrument (1) Optimum Ranges (Ug/l) or Low	Furance/AA (mg/kg) High	ICP-AA Linear Ranges (ug/l) Low	High	Limits for Solids (2) (mg/kg) ICP	FAA
<u>Metals</u>									
Aluminum	200.7 CLP-M	200	16.0			16.0	100K	3.2	
Antimony	200.7 CLP-M	60	27.0			27.0	100K	5.4	
Arsenic	206.2 CLP-M	10		3.0	5	100			0.6
Barium	200.7 CLP-M	200	2.0			2.0	100K	0.4	
Beryllium	200.7 CLP-M	5	1.0			1.0	100K	0.2	
Cadmium	213.2 CLP-M	5		1.0	0.5	10.0			0.02
Calcium	200.7 CLP-M	5000	10.0			10.0	200K	2.0	
Chromium	200.7 CLP-M	10	3.0			3.0	100K	0.6	
Cobalt	200.7 CLP-M	50	6.0			6.0	100K	1.2	
Copper	200.7 CLP-M	25	3.0			3.0	100K	0.6	
Iron	200.7 CLP-M	100	4.0			4.0	100K	0.8	
Lead	239.2 CLP-M	5		1.0	5	100			0.2
Magnesium	200.7 CLP-M	5000	1.0			1.0	40K	0.2	
Manganese	200.7 CLP-M	15	2.0			2.0	100K	0.4	
Mercury (water)	245.1 CLP-M	0.2		0.2	0.2	10			
Mercury (sediments)	245.5 CLP-M	0.1		0.1	0.1	5.0			0.1
Nickel	200.7 CLP-M	40	11.0			11.0	100K	2.2	
Potassium	200.7 CLP-M	5000	500.0			500.0	200K	100	
Selenium	270.2 CLP-M	5		3.0	5	100			0.6
Silver	200.7 CLP-M	10	4.0			4.0	100K	0.8	
Sodium	200.7 CLP-M	5000	34.0			34.0	200K	6.8	
Thallium	279.2 CLP-M	10		4.0	5	100			0.8
Vanadium	200.7 CLP-M	50	3.0			3.0	100K	0.6	
Zinc	200.7 CLP-M	20	2.0			2.0	70K	0.4	
<u>Non-Metals</u>									
Cyanide (3)	335.2 CLP-M	10		5.0					
pH	US EPA	150.1 2.0 - 12.0						0.5	
Specific- Conductance	US EPA	120.1 10 umho/cm							

(1) Vary slightly; updated quarterly.

(2) Detection limits for an extract of 1 gram of solid in 200 ml of extractant based upon current instrument Detection Levels (IDLs).

(3) Cyanide in water and solids by reflux-distillation and spectrophotometric measurement. Conductivity and pH by standard instrumentation. ICP and FAA methods are not employed.

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